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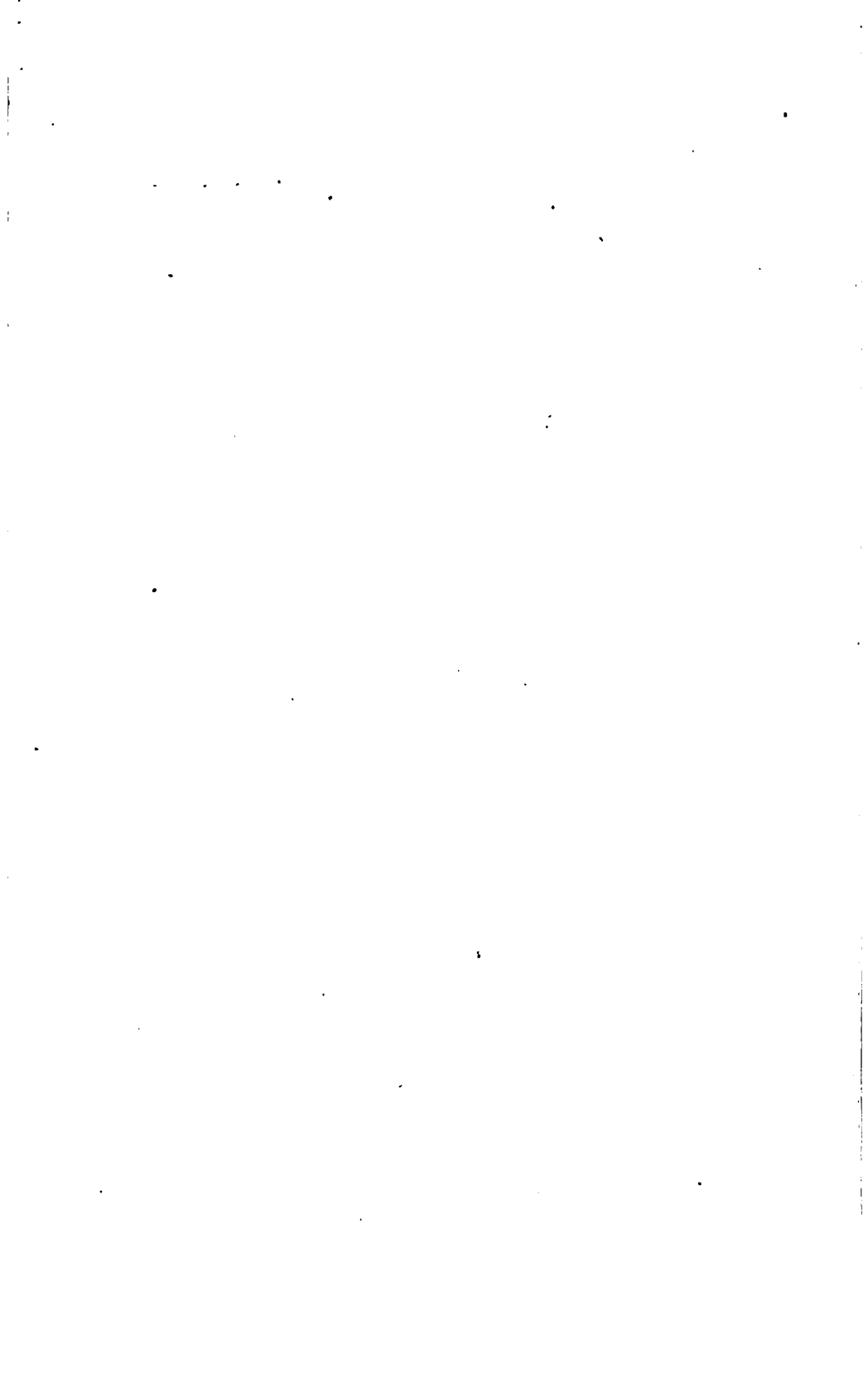
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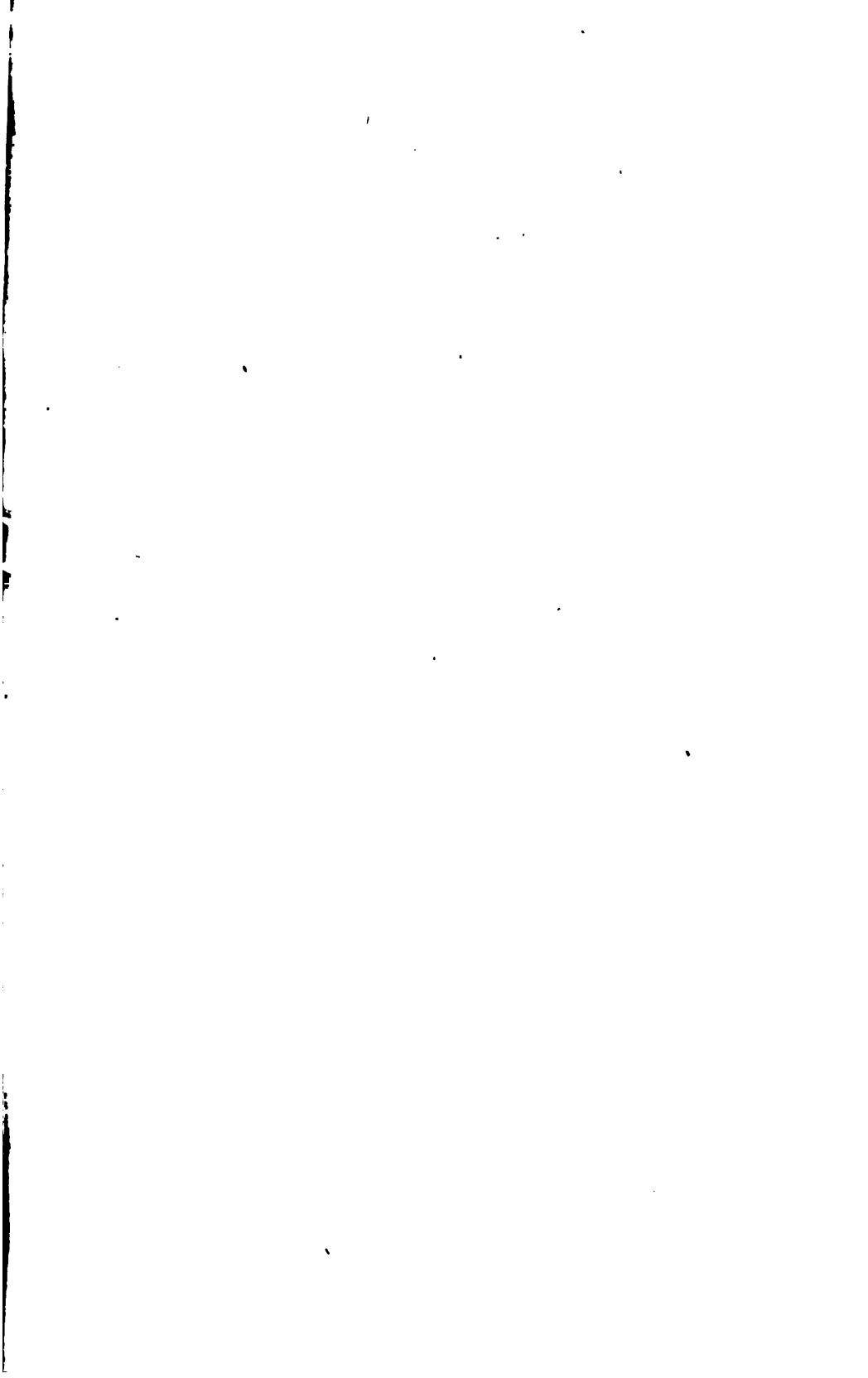
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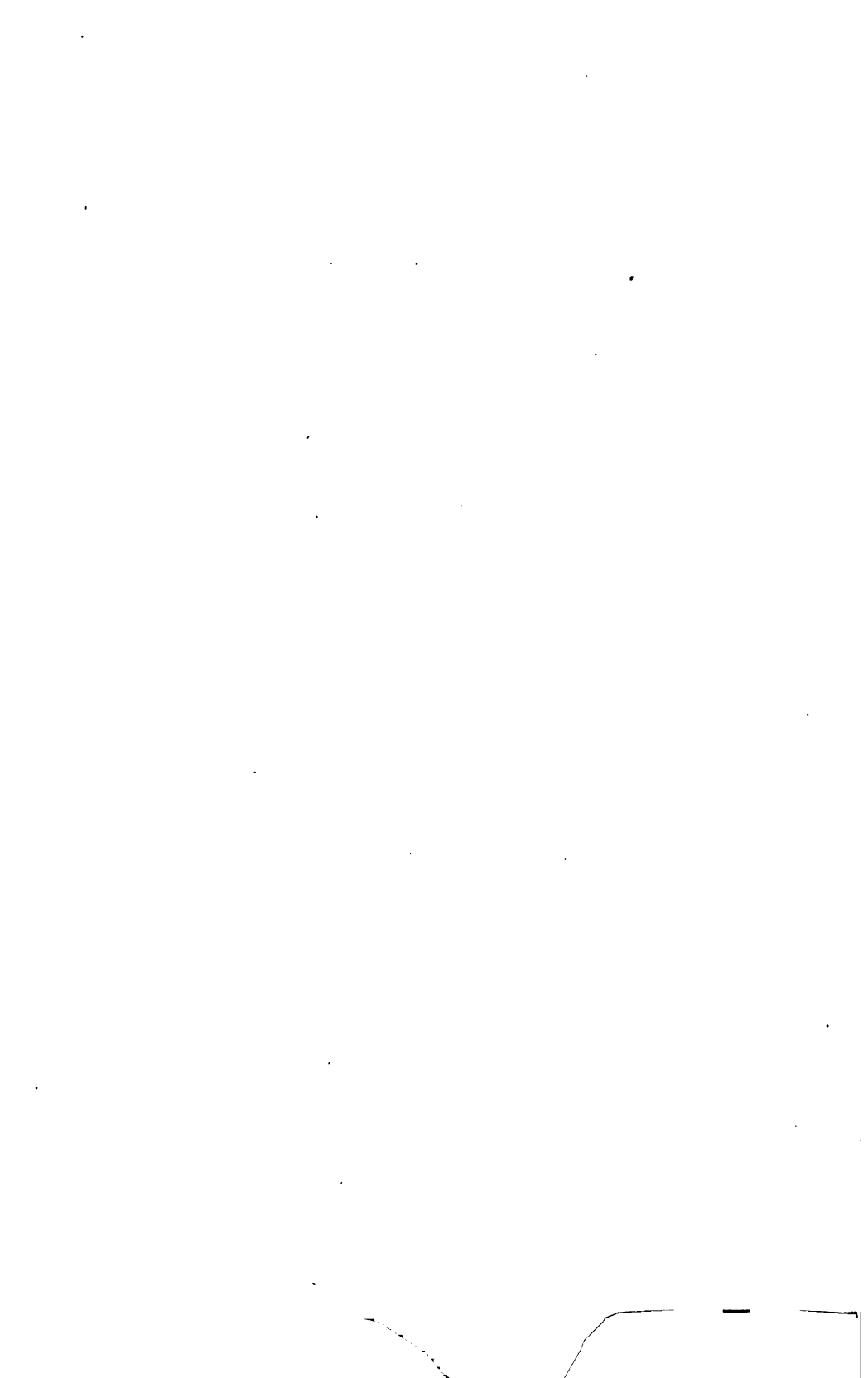
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U.S.*

**REPORT**  
**OF THE**  
**TESTS OF METALS**  
**AND**  
**OTHER MATERIALS**  
**FOR**  
**INDUSTRIAL PURPOSES**

**MADE WITH THE**  
**UNITED STATES TESTING MACHINE AT WATERTOWN ARSENAL,**  
**MASSACHUSETTS,**  
**DURING**  
**THE FISCAL YEAR ENDED JUNE 30, 1892.**



**WASHINGTON:**  
**GOVERNMENT PRINTING OFFICE.**  
**1893.**





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**LETTER**

**FROM**

**THE ACTING SECRETARY OF WAR,**

**TRANSMITTING**

*The report of the commanding officer of the Watertown Arsenal of tests of iron, steel, and other materials for industrial purposes, made during the fiscal year ending June 30, 1892.*

---

**DECEMBER 7, 1892.**—Referred to the Committee on Manufactures and ordered to be printed.

---

**WAR DEPARTMENT,**  
*Washington, December 5, 1892.*

**SIR:** In compliance with the provisions of the act of Congress entitled "An act making appropriations for sundry civil expenses of the Government for the fiscal year ending June 30, 1886, and for other purposes," approved March 3, 1885 (23 Stats., p. 502), I have the honor to transmit herewith the report of the commanding officer of the Watertown Arsenal of "Tests of iron, steel, and other materials for industrial purposes," made with the United States testing machine during the fiscal year ended June 30, 1892.

Very respectfully,

**J. M. SCHOFIELD,**  
*Major-General, Acting Secretary of War.*

**The SPEAKER OF THE HOUSE OF REPRESENTATIVES.**

---

**WATERTOWN ARSENAL,**  
*Watertown, Mass., November 22, 1892.*

**SIR:** I have the honor to submit herewith the following report of tests of materials made at this arsenal during the fiscal year ending June 30, 1892, in compliance with the requirements of law.

The total number of specimens tested during the year is 2,469, classified as follows:

Gun specimens.....	845
For Ordnance Department.....	187
For other Government departments.....	106
Investigation tests.....	412
Tests for private parties.....	909

The receipts and expenditures were as follows:

Amount appropriated for testing machine and testing work.....	\$10,000.00
Received during the year for private tests.....	1,363.13
<b>Total received .....</b>	<b>11,363.13</b>
Amount expended for services and labor.....	8,749.26
Amount expended for light, power, tools, implements, and material for test.....	2,613.87
<b>Total expended.....</b>	<b>11,363.13</b>

As a matter of general interest it may be advisable to repeat the rules governing the operations of the testing machine.

All tests are comprised under three classes:

- (1) Tests made for the various departments of the Government.
- (2) Tests made for private parties.
- (3) Investigation tests.

The first and third series of tests are made at public expense; the second series are made upon application to the commanding officer of the arsenal, and are paid for by the parties for whom the tests are made. A list of the parties availing themselves of this privilege is appended to the report.

The first series of tests is generally upon specimens representing material used in the current service of the various departments of the Government, and has for its object the determination of the physical qualities of the material presented for acceptance. The record of these tests is found in the first part of the accompanying report.

Investigative tests have been continued upon the following subjects:

Alternate strains in iron and steel; the hardening and tempering of steel; the endurance of bars subjected to repeated transverse stresses in the form of rotating shafts; steel rails, driving-wheel tires, and axles in the class of railway material; also some observations on the effects of heat transmission and the strength of hot stones, together with a number of tests upon isolated features of interest which are not included in the more comprehensive series of investigations.

The series of tests on the effects of alternate strains by direct tension and compression has been completed.

The data contained in this and preceding reports supply some very important information upon the immediate effects of overstraining by alternate stresses, and the influence of time in modifying or effacing these effects.

The endurance tests of rotating shafts take up a line of investigation closely allied to the above series.

In both series attention has been centered upon the phases of deterioration which the metal undergoes prior to rupture—fundamental information when considering questions of permanency in metallic structures.

The effects of repeated transverse stresses on the direct tensile strength of the metal has been shown by means of annular specimens taken from shafts that have worked under different fiber stresses and different periods of rotation, the records in the body of the report showing wherein there has been gain or loss over the primitive strength of the metal, according to conditions of the tests.

Endurance tests of rotating shafts are in continuance, and it is intended to fully investigate the effects of overstraining and repeated stresses as exemplified in the annular specimens taken from these shafts, and furthermore investigating the effects of annealing on the strength of material after different periods of exposure to overloads.

Preliminary experiments on hardening and tempering steel with special reference to the manufacture of Belleville springs for sea-coast gun carriages have been carried on, and it is intended to extend the observations to a general investigation of the subject of tempering of steel, operating with steels covering a wide range in chemical composition.

Much obscurity at present surrounds this subject, and it is not generally understood what treatment is necessary to produce maximum results as regards strength, or how the physical properties may be controlled by varying the tempering methods.

Additional tests were made with steel rails and the peculiarities observed in the tests of the previous year received further confirmation—that is, in regard to the loss in ductility of the metal in the heads of old rails—by reason of which old rails are found low in strength and toughness when bent transversely with the head on the tension side of the bend, whereas bending in the opposite direction develops greater strength and toughness.

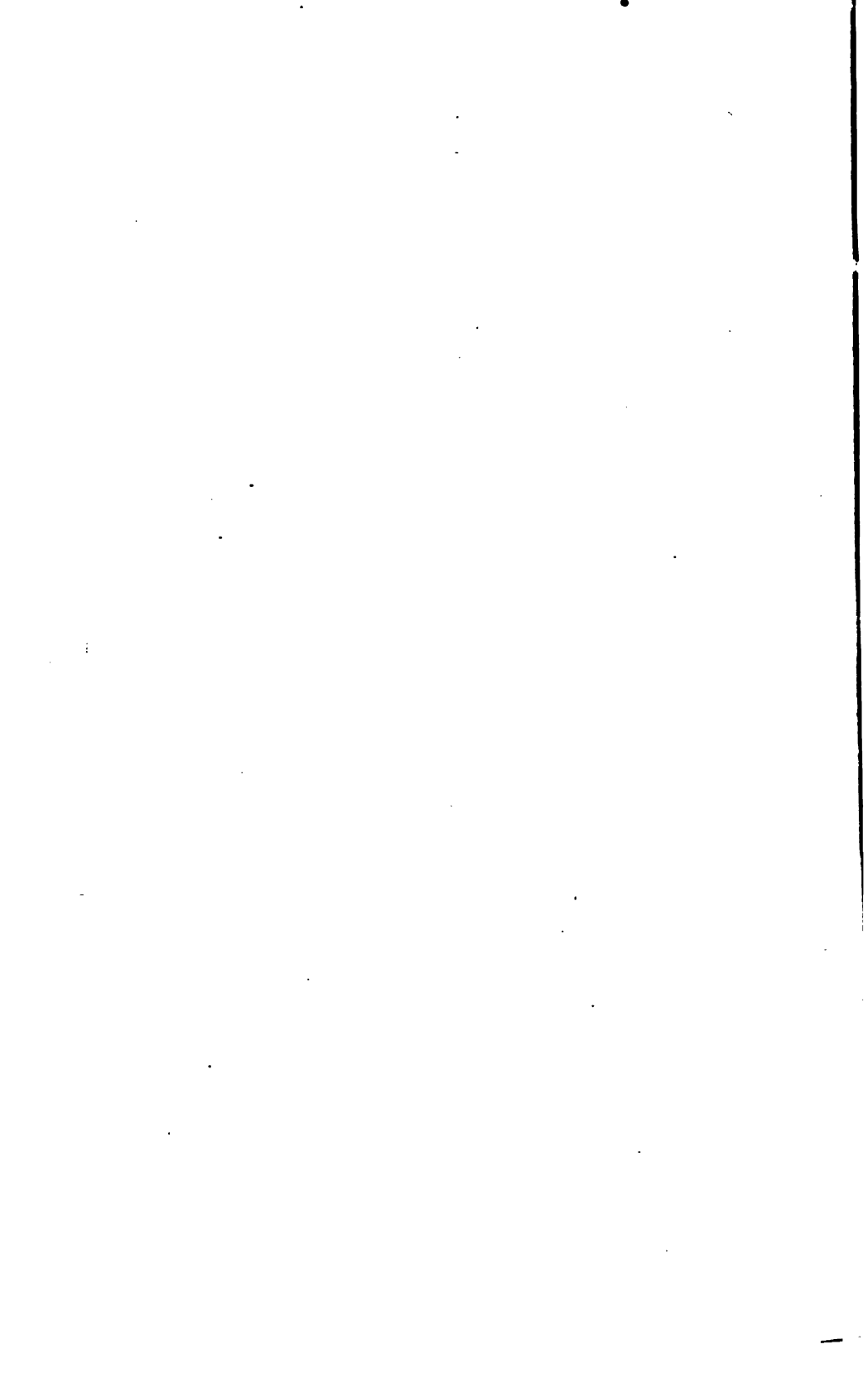
The apparatus has been completed for testing the section of an 8-inch tube by hydrostatic pressure, and a comprehensive series of tests will be undertaken during the present fiscal year, which will embrace observations within the elastic limit of the metal upon the effects of interior and exterior pressures acting singly and together, also when accompanied with longitudinal stresses of tension and of compression.

Very respectfully, your obedient servant,

J. W. REILLY,

*Major, Ord. Dept., U. S. Army, Commanding.*

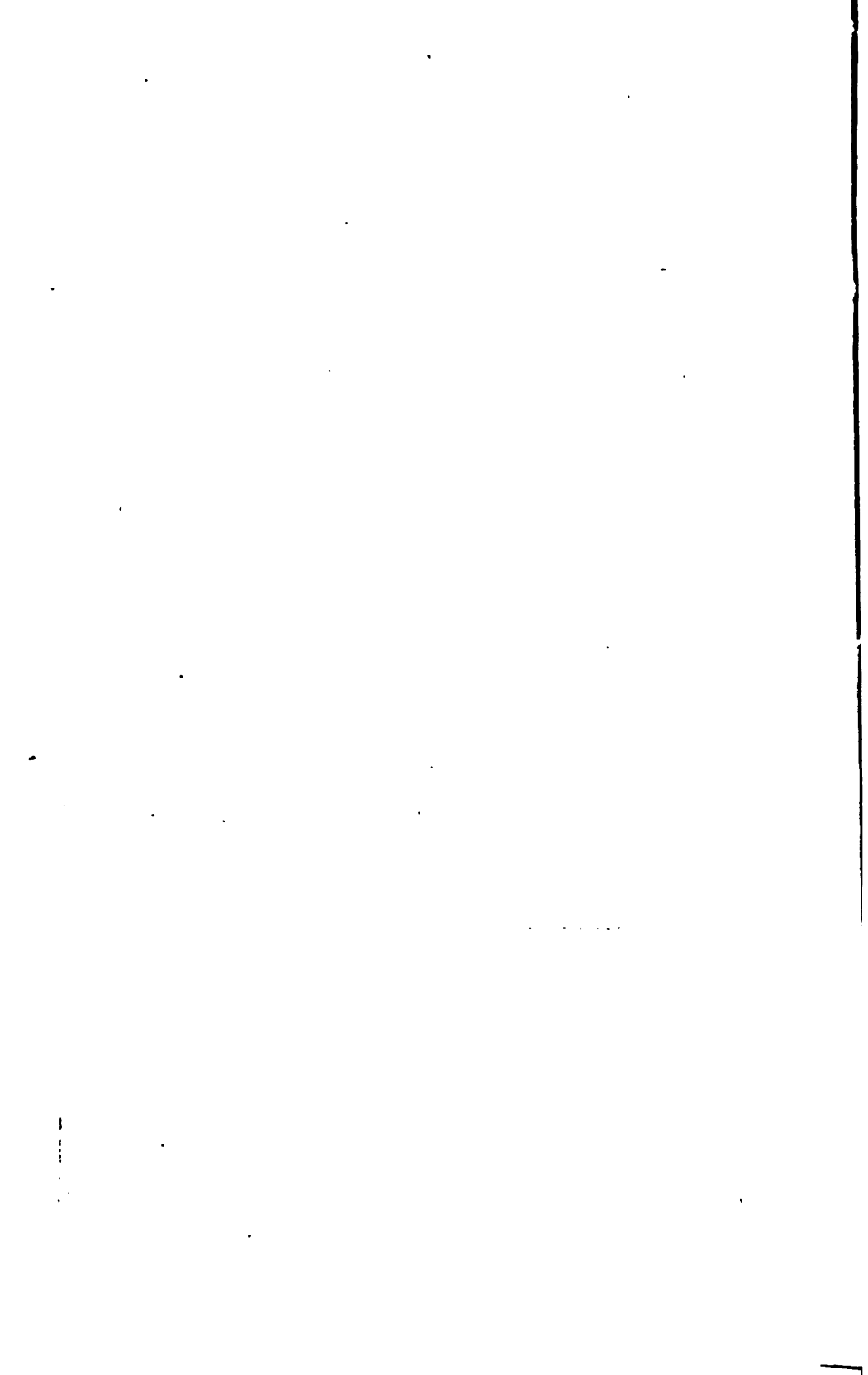
The CHIEF OF ORDNANCE, U. S. ARMY,  
*Washington, D. C.*



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**REPORT**  
**OF THE**  
**TESTS OF METALS AND OTHER MATERIALS**  
**FOR**  
**INDUSTRIAL PURPOSES**  
**MADE WITH THE**  
**UNITED STATES TESTING MACHINE AT WATERTOWN**  
**ARSENAL, MASSACHUSETTS,**  
**DURING THE**  
**FISCAL YEAR ENDED JUNE 30, 1892.**

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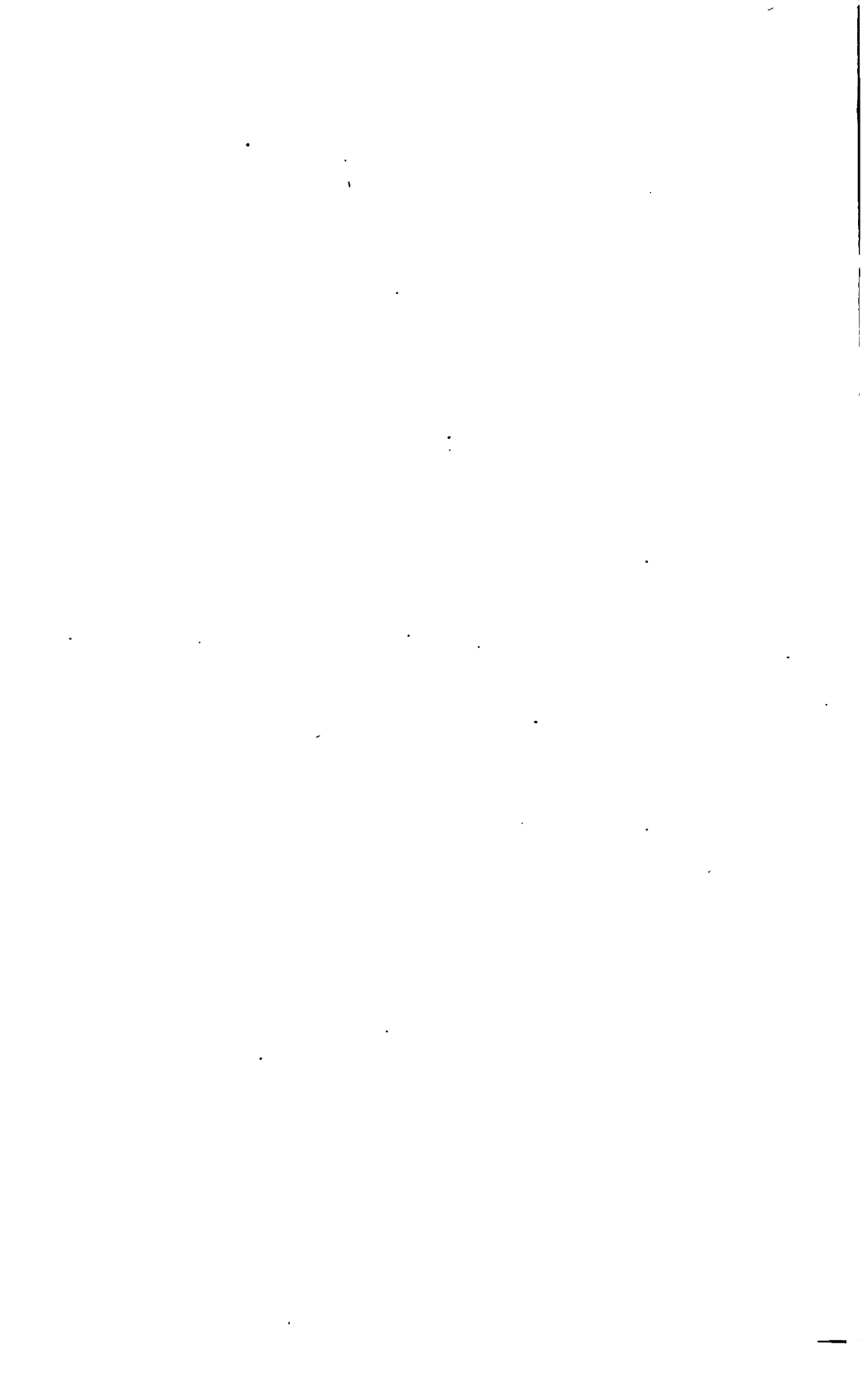
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**3.2-INCH B. L. STEEL FIELD GUNS.**

**SPECIMENS FROM TUBES AND JACKETS.**

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TUBE No. 115.

No. 4514.

Marks, <sup>32 R<sub>115</sub> T</sup>  
B T M

Diameter, ".505.

Sectional area, .20 square inch.

Gauged length, 2".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
200	1,000	0.	0.	0.	0.	
1,000	5,000	.000100	.000100	0.	0.	
2,000	10,000	.000200	.000100	-----	-----	
4,000	20,000	.000500	.000400	-----	-----	
6,000	30,000	.000900	.000300	-----	-----	
7,000	35,000	.001050	.000150	0.	-----	
8,000	40,000	.001150	.000100	-----	-----	
8,400	42,000	.001200	.000050	-.000050	-.000050	
8,600	43,000	.001250	.000050	-----	-----	
8,800	44,000	.001300	.000050	-----	-----	
9,000	45,000	.001350	.000050	-----	-----	
9,200	46,000	.001400	0.00050	-----	-----	
9,400	47,000	.001450	.000050	-----	-----	
9,600	48,000	.002500	.001050	-----	-----	
9,800	49,000	.003500	.001000	-----	-----	
10,000	50,000	.005000	.001500	-----	-----	
10,200	51,000	.006000	.001000	-----	-----	
10,400	52,000	.008100	.002100	-----	-----	
16,980	84,900	-----	-----	-----	-----	Tensile strength.

General summary.

Tensile strength per square inch of original section .....	pounds..	84,000
Elastic limit per square inch of original section .....	do...	47,000
Elongation per inch after rupture .....	inch..	.1900
Elongation per inch under strain at elastic limit .....	do...	.001450
Reduction in diameter at point of rupture .....	do...	.005
Reduction in area after rupture, per cent of original section .....		34.0
Position of rupture .....		"7 from neck
Character of broken surface .....		silky serrated, 80 per cent; granular, 20 per cent
Elongation of inch sections .....		"29", "09

TUBE No. 116.

No. 4519.

Marks, <sup>32</sup> E, M T  
 M T, M  
 Diameter, ".505.  
 Sectional area, .20 square inch.  
 Gauged length, 2".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000100	.000100	0.	0.	
2,000	10,000	.000250	.000150	.....	.....	
4,000	20,000	.000550	.000300	.....	.....	
6,000	30,000	.000900	.000350	.....	.....	
7,000	35,000	.001100	.000200	0.	.....	
8,000	40,000	.001350	.000250	.....	.....	
8,400	42,000	.001450	.000100	0.	.....	
8,800	43,000	.001500	.000050	.....	.....	
8,800	44,000	.001700	.000200	.....	.....	
9,000	45,000	.002500	.000800	.....	.....	
9,200	46,000	.004900	.002400	.....	.....	
9,400	47,000	.006150	.001250	.....	.....	
9,600	48,000	.007400	.001250	.....	.....	
16,870	84,350	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section.....	pounds..	84,350
Elastic limit per square inch of original section.....	do..	43,000
Elongation per inch after rupture.....	inch..	.2500
Elongation per inch under strain at elastic limit.....	do..	.001500
Reduction in diameter at point of rupture.....	do..	.185
Reduction in area after rupture, per cent of original section.....	do..	46.2
Position of rupture.....	1".05 from neck	
Character of broken surface.....	silky	
Elongation of inch sections.....	.16 "	.34"

TUBE No. 117.

No. 4520.

Marks, <sup>22</sup>R<sub>117</sub>T  
B T M

Diameter, ".505.

Sectional area, .20 square inch.

Gauged length, 2".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
300	1,000	0.	0.	0.	0.	
1,000	5,000	.000100	.000100	0.	0.	
2,000	10,000	.000350	.000250	.....	.....	
4,000	20,000	.000800	.000250	.....	.....	
6,000	30,000	.000850	.000250	.....	.....	
7,000	35,000	.001100	.000250	— .000050	— .000050	
8,000	40,000	.001200	.000100	.....	.....	
8,400	42,000	.001250	.000050	— .000050	0.	
8,600	43,000	.001250	0.	.....	.....	
8,800	44,000	.001300	.000050	.....	.....	
9,000	45,000	.001350	.000050	.....	.....	
9,200	46,000	.001450	.000100	.....	.....	
9,400	47,000	.001500	.000050	.....	.....	
9,600	48,000	.001550	.000050	.....	.....	
9,800	49,000	.003500	.001850	.....	.....	
10,000	50,000	.005000	.001500	.....	.....	
10,200	51,000	.007350	.002350	.....	.....	
10,400	52,000	.008500	.001150	.....	.....	
10,600	53,000	.009500	.001000	.....	.....	
17,040	85,200	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section.....	pounds..	85,200
Elastic limit per square inch of original section.....	do...	48,000
Elongation per inch after rupture.....	inch..	.1850
Elongation per inch under strain at elastic limit.....	do...	.001550
Reduction in diameter at point of rupture.....	do...	.105
Reduction in area after rupture, per cent of original section.....		37.1
Position of rupture.....	"	.45 from neck
Character of broken surface.....		silky serrated
Elongation of inch sections.....	"	.09, ".28*

## TUBE NO. 120.

No. 4521.

Marks, <sup>32 R, T</sup><sub>B T, M</sub>Diameter, <sup>11</sup>/<sub>16</sub>, 505.

Sectional area, .20 square inch.

Gauged length, 2".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
200	1,000	0.	0.	0.	0.	
1,000	5,000	.000100	.000100	0.	.....	
2,000	10,000	.000250	.000150	.....	.....	
4,000	20,000	.000550	.000300	.....	.....	
6,000	30,000	.000900	.000550	.....	.....	
7,000	35,000	.00100	.000200	0.	.....	
8,000	40,000	.001250	.00050	.....	.....	
8,200	41,000	.001300	.000050	.....	.....	
8,400	42,000	.00150	.001850	.004400	.004400	
8,600	43,000	.006900	.000750	.....	.....	
8,800	44,000	.007800	.000900	.....	.....	
9,000	45,000	.008900	.001100	.....	.....	
9,200	46,000	.010000	.001100	.....	.....	Tensile strength.
16,010	80,050	.....	.....	.....	.....	

## General summary.

Tensile strength per square inch of original section .....	pounds..	80,050
Elastic limit per square inch of original section .....	do..	41,000
Elongation per inch after rupture .....	inch..	.2450
Elongation per inch under strain at elastic limit .....	do..	.001300
Reduction in diameter at point of rupture .....	do..	.105
Reduction in area after rupture, per cent of original section .....		37.1
Position of rupture .....	"	.80 from neck
Character of broken surface .....		alky serrated, trace of granulation
Elongation of inch sections .....	"	.34, ".15



## JACKET NO. 108.

No. 4515.

Marks, <sup>32</sup>R<sub>103</sub> J  
M T, MDiameter, <sup>11</sup>.505.

Sectional area, .20 square inch.

Gauged length, 2''.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000100	.000100	0.	.....	
2,000	10,000	.000200	.000100	.....	.....	
4,000	20,000	.000500	.000350	.....	.....	
6,000	30,000	.000850	.000300	.....	.....	
8,000	40,000	.001200	.000350	0.	.....	
9,200	46,000	.001500	.000300	0.	.....	
9,400	47,000	.001550	.000050	.....	.....	
9,600	48,000	.001600	.000050	.....	.....	
9,800	49,000	.001600	0.	.....	.....	
10,000	50,000	.001650	.000050	.....	.....	Elastic limit.
10,200	51,000	.001850	.000200	.....	.....	
10,400	52,000	.003400	.001550	.....	.....	
10,600	53,000	.004400	.001000	.....	.....	
10,800	54,000	.005400	.001000	.....	.....	
11,000	55,000	.006500	.001100	.....	.....	Tensile strength.
18,410	92,050	.....	.....	.....	.....	

*General summary.*

Tensile strength per square inch of original section .....	pounds..	92,050
Elastic limit per square inch of original section .....	do..	50,000
Elongation per inch after rupture .....	inch..	.2350
Elongation per inch under strain at elastic limit.....	do..	.001650
Reduction in diameter at point of rupture .....	do..	.125
Reduction in area after rupture, per cent of original section .....	do..	43.3
Position of rupture .....	1'' .20 from neck	
Character of broken surface .....	silky	
Elongation of inch sections .....	" 21" " 26"	





## JACKET NO. 111.

No. 4517.

Marks,  $\frac{32}{M} R_{11} \frac{J}{M}$ Diameter,  $\frac{1}{16}$  .505.

Sectional area, .20 square inch.

Gauged length, 2".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000100	.000100	0.	0.	
2,000	10,000	.000350	.000250	.....	.....	
4,000	20,000	.000600	.000250	.....	.....	
6,000	30,000	.000900	.000300	.....	.....	
8,000	40,000	.001350	.000450	0.	.....	
9,200	46,000	.001550	.000200	0.	.....	
9,400	47,000	.001600	.000050	.....	.....	
9,600	48,000	.001600	0.	.....	.....	
9,800	49,000	.001650	.000050	.....	.....	
10,000	50,000	.001750	.000100	.....	.....	
10,200	51,000	.001850	.000100	.....	.....	
10,400	52,000	.001900	.000050	.....	.....	Elastic limit.
10,600	53,000	.002100	.000200	.....	.....	
10,800	54,000	.002300	.000600	.....	.....	
11,000	55,000	.003300	.001000	.....	.....	
11,200	56,000	.005250	.001350	.....	.....	
11,400	57,000	.006500	.001250	.....	.....	Tensile strength.
18,520	92,600	.....	.....	.....	.....	

## General summary.

Tensile strength per square inch of original section .....	pounds ..	92,600
Elastic limit per square inch of original section .....	do ..	52,000
Elongation per inch after rupture .....	inch ..	.2000
Elongation per inch under strain at elastic limit .....	do ..	.001900
Reduction in diameter at point of rupture .....	do ..	.105
Reduction in area after rupture, per cent of original section .....		37.1
Position of rupture .....	1" .15 from neck	
Character of broken surface .....	granular 60 per cent, silky serrated 40 per cent	
Elongation of inch sections .....	" .21", ".19	

JACKET No. 113.

No. 4516.

Marks, <sup>23 R, 11 J</sup>  
<sub>M T, I</sub>  
 Diameter, ".505.  
 Sectional area, .20 square inch.  
 Gauged length, 2".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000100	.000100	0.	.....	
2,000	10,000	.000350	.000250	.....	.....	
4,000	20,000	.000800	.000250	.....	.....	
6,000	30,000	.000900	.000300	.....	.....	
8,000	40,000	.001350	.000450	0.	.....	
9,200	46,000	.001550	.000200	0.	.....	
9,400	47,000	.003350	.001800	.....	.....	
9,600	48,000	.005350	.002000	.....	.....	Elastic limit.
9,800	49,000	.008900	.003550	.....	.....	
10,000	50,000	.010000	.001100	.....	.....	
10,200	51,000	.011200	.001200	.....	.....	
16,680	83,450	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section .....	pounds..	83,450
Elastic limit per square inch of original section .....	do...	46,000
Elongation per inch after rupture .....	inch..	.2450
Elongation per inch under strain at elastic limit .....	do...	.001550
Reduction in diameter at point of rupture .....	do...	.125
Reduction in area after rupture, per cent of original section .....		43.3
Position of rupture .....		1".12 from neck
Character of broken surface .....		silky serrated
Elongation of inch sections .....		".29", ".20"

## JACKET NO. 114.

No. 4523.

Marks, <sup>82 R. M. J.</sup><sub>M T M</sub>

Diameter, ".505.

Sectional area, .20 square inch.

Gauged length, 2".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000100	.000100	0.	.....	
2,000	10,000	.000350	.000250	.....	.....	
4,000	20,000	.000600	.000250	.....	.....	
6,000	30,000	.000900	.000300	.....	.....	
8,000	40,000	.001350	.000450	.000050	.000050	
9,200	48,000	.001500	.000150	.....	0.	
9,400	47,000	.001550	.000050	.....	.....	
9,600	48,000	.001600	.000050	.....	.....	
9,800	49,000	.001650	.000050	.....	.....	
10,000	50,000	.001700	.000050	.....	.....	Elastic limit.
10,200	51,000	.002050	.000350	.....	.....	
10,400	52,000	.002600	.000550	.....	.....	
10,600	53,000	.003550	.000950	.....	.....	
10,800	54,000	.004900	.001350	.....	.....	
11,000	55,000	.006050	.001150	.....	.....	Tensile strength.
18,410	92,050	.....	.....	.....	.....	

## General summary.

Tensile strength per square inch of original section .....	pounds..	92,050
Elastic limit per square inch of original section .....	do.	50,900
Elongation per inch after rupture .....	inch.	.2250
Elongation per inch under strain at elastic limit .....	do.	.001700
Reduction in diameter at point of rupture .....	do.	.125
Reduction in area after rupture, per cent of original section .....		43.3
Position of rupture .....		1.41 from neck
Character of broken surface .....		silky, serrated
Elongation of inch sections .....		".16"/".31

## TABULATION OF TENSION SPECIMENS FROM 3.2-INCH B. L. STEEL FIELD GUNS.

[Stems 2 inches long, ".505 diameter.]

No. of test.	Position in gun.	Location of specimens.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation.	Contraction of area.	Appearance of fracture.
			Pounds.	Pounds.	Per cent.	Per cent.	
4514	Tube No. 115....	Middle.	47,000	84,900	19.0	34.0	Silky serrated 80 per cent, granular 20 per cent.*
4519	Tube No. 116....	do	43,000	84,350	25.0	46.2	Silky.†
4520	Tube No. 117....	do	48,000	85,200	18.5	37.1	Silky, serrated.*
4521	Tube No. 120....	do	41,000	80,050	24.5	37.1	Silky, serrated, trace of granulation.*
4522	Tube No. 122....	do	45,000	80,750	21.0	46.2	Silky, serrated.*
4515	Jacket No. 108....	Middle.	50,000	92,050	23.5	43.3	Silky.†
4518	Jacket No. 110....	do	52,000	91,700	22.5	43.3	Silky, serrated.†
4517	Jacket No. 111....	do	52,000	92,600	20.0	37.1	Granular 60 per cent; silky, serrated 40 per cent.†
4516	Jacket No. 113....	Inside.	46,000	83,450	24.5	43.3	Silky, serrated.†
4523	Jacket No. 114....	Middle.	50,000	92,050	23.5	43.3	Do.†

\* Breech end.

† Muzzle end.

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**3.6-INCH B. L. STEEL FIELD RIFLES.**

**SPECIMENS FROM TUBES AND JACKETS.**



TUBE NO. 1.

No. 4685.

Marks, <sup>88 E, T</sup>  
<sub>B T, M</sub>

Diameter, <sup>1</sup>/<sub>16</sub> .505.

Sectional area, .20 square inch.

Gauged length, 2".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000100	.000100	0.	0.	
2,000	10,000	.000850	.000250	0.	0.	
4,000	20,000	.000700	.000350	0.	0.	
6,000	30,000	.001000	.000300	0.	0.	
7,000	35,000	.001200	.000200	0.	0.	
8,000	40,000	.001350	.000150	0.	0.	
8,400	42,000	.001400	.000050	0.	0.	
8,800	43,000	.001450	.000050	0.	0.	
8,900	44,000	.001450	0.	0.	0.	
9,000	45,000	.001500	.000050	0.	0.	Elastic limit.
9,200	46,000	.001500	0.	0.	0.	
9,400	47,000	.001550	.000050	0.	0.	
9,600	48,000	.001550	0.	0.	0.	
9,800	49,000	.001600	.000050	0.	0.	
10,000	50,000	.001600	0.	0.	0.	
10,200	51,000	.001650	.000050	0.	0.	
10,400	52,000	.002200	.000550	0.	0.	
10,800	53,000	.004000	.001800	0.	0.	
10,900	54,000	.006250	.002250	0.	0.	
11,000	55,000	.007250	.001000	0.	0.	Tensile strength.
11,200	56,000	.007950	.000700	0.	0.	
18,020	93,100	.....	.....	.....	.....	

General summary.

Tensile strength per square inch of original section.....	pounds..	93,100
Elastic limit per square inch of original section.....	do...	51,000
Elongation per inch after rupture.....	inch...	.1700
Elongation per inch under strain at elastic limit.....	do...	.001650
Reduction in diameter at point of rupture.....	do...	.065
Reduction in area after rupture, per cent of original section.....	do...	23.9
Position of rupture.....	"	5 from neck
Character of broken surface.....	granular, silky spot at circumference.	
Elongation of inch sections.....	"	.14, ".20

TUBE No. 2.

No. 4686.

Marks, <sup>36 R, T</sup><sub>M T, M</sub>

Diameter, ".505.

Sectional area, .20 square inch.

Gauged length, 2".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
300	1, 000	0.	0.	0.	0.	Initial load.
1, 000	5, 000	.000050	.000050	0.	0.	
2, 000	10, 000	.000300	.000250	.....	.....	
4, 000	20, 000	.000650	.000350	.....	.....	
6, 000	30, 000	.001000	.000350	.....	.....	
7, 000	35, 000	.001100	.000100	0.	.....	
8, 000	40, 000	.001250	.000150	.....	.....	
8, 400	42, 000	.001350	.000100	0.	.....	
8, 600	43, 000	.001400	.000050	.....	.....	
8, 800	44, 000	.001450	.000050	.....	.....	
9, 000	45, 000	.001450	0.	.....	.....	
9, 200	46, 000	.001500	.000050	.....	.....	
9, 400	47, 000	.001550	.000050	.....	.....	
9, 600	48, 000	.001600	.000050	.....	.....	
9, 800	49, 000	.001650	.000050	.....	.....	
10, 000	50, 000	.001700	.000050	.....	.....	Elastic limit.
		.002800	.000900	.....	.....	
10, 200	51, 000	.003250	.000650	.....	.....	
10, 400	52, 000	.004000	.000750	.....	.....	
10, 600	53, 000	.006000	.002000	.....	.....	
10, 800	54, 000	.008000	.002000	.....	.....	
11, 000	55, 000	.009000	.001000	.....	.....	
17, 970	89, 850	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section .....	pounds..	89, 850
Elastic limit per square inch of original section .....	do..	50, 000
Elongation per inch after rupture .....	inch..	.2050
Elongation per inch under strain at elastic limit .....	do..	.001700
Reduction in diameter at point of rupture .....	do..	.105
Reduction in area after rupture, per cent of original section .....		37.1
Position of rupture .....		.70 from neck
Character of broken surface .....		silky, serrated
Elongation of inch sections .....	"", "	.30, ".11



TUBE NO. 3.

No. 4687.

Marks, <sup>38 R, T</sup><sub>B T, O</sub>

Diameter, ".505.

Sectional area, .20 square inch.

Gauged length, 2".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
200	1,000	0.	0.	0.	0.	
1,000	5,000	.000050	.000050	0.	0.	
2,000	10,000	.000200	.000150	.....	.....	
4,000	20,000	.000800	.000200	.....	.....	
6,000	30,000	.000950	.000350	.....	.....	
7,000	35,000	.001100	.000150	0.	.....	
8,000	40,000	.001250	.000150	.....	.....	
8,400	42,000	.001300	.000050	0.	.....	
8,600	43,000	.001350	.000050	.....	.....	
8,800	44,000	.001400	.000050	.....	.....	
9,000	45,000	.001450	.000050	.....	.....	
9,200	46,000	.001450	0.	.....	.....	
9,400	47,000	.001500	.000050	.....	.....	
9,600	48,000	.001500	0.	.....	.....	
9,800	49,000	.001550	.000050	.....	.....	
10,000	50,000	.001550	0.	.....	.....	
10,200	51,000	.004950	.003400	.....	.....	
10,400	52,000	.008250	.003300	.....	.....	
10,600	53,000	.009450	.001200	.....	.....	
10,800	54,000	.010250	.000800	.....	.....	
11,000	55,000	.010750	.000500	.....	.....	
17,840	89,200	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section.....	pounds..	89,200
Elastic limit per square inch of original section.....	do...	50,000
Elongation per inch after rupture.....	inch:	.2450
Elongation per inch under strain at elastic limit.....	do...	.001550
Reduction in diameter at point of rupture.....	do...	.125
Reduction in area after rupture, per cent of original section.....		43.3
Position of rupture.....		1".22 from neck
Character of broken surface.....		silky
Elongation of inch sections.....		".22, ".27"

## TUBE NO. 13.

No. 4712.

Marks,  $\frac{85}{M}$   $\frac{T}{T}$ 

Diameter, ".505.

Sectional area, .20 square inch.

Gauged length, 2".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
200	1,000	0.	0.	0.	0.	
1,000	5,000	.000150	.000150	0.	0.	
2,000	10,000	.000400	.000250	.....	.....	
4,000	20,000	.000850	.000250	.....	.....	
6,000	30,000	.001050	.000400	.....	.....	
7,000	35,000	.001300	.000250	.0	.....	
8,000	40,000	.001500	.000200	.....	.....	
8,400	42,000	.001550	.000050	.0	.....	
8,600	43,000	.001600	.000050	.....	.....	
8,800	44,000	.001600	0.	.....	.....	
9,000	45,000	.001850	.000050	.....	.....	
9,200	46,000	.001700	.000050	.....	.....	
9,400	47,000	.003300	.001800	.....	.....	
9,600	48,000	.005050	.001750	.....	.....	
9,800	49,000	.006000	.000250	.....	.....	
10,000	50,000	.007000	.001000	.....	.....	
10,200	51,000	.008500	.001500	.....	.....	
17,120	85,600	.....	.....	.....	.....	Tensile strength.

*General summary.*

Tensile strength per square inch of original section .....	pounds..	85,600
Elastic limit per square inch of original section .....	do...	46,000
Elongation per inch after rupture .....	inch...	.2200
Elongation per inch under strain at elastic limit .....	do...	.001700
Reduction in diameter at point of rupture .....	do...	.145
Reduction in area after rupture, per cent of original section .....		49.1
Position of rupture .....	"	.75 from neck.
Character of broken surface .....		Silky.
Elongation of inch sections .....	"	.34, ".10

TUBE No. 14.

No. 4711.

Marks, <sup>36 R, T</sup><sub>B T, M</sub>

Diameter, <sup>11</sup>/<sub>16</sub> .505.

Sectional area, .20 square inch.

Gauged length, 2''.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000100	.000100	0.	0.	
2,000	10,000	.000400	.000300	.....	.....	
4,000	20,000	.000850	.000450	.....	.....	
6,000	30,000	.001200	.000350	.....	.....	
7,000	35,000	.001450	.000250	0.	.....	
8,000	40,000	.001650	.000200	.....	.....	
8,200	41,000	.001700	.000050	.....	.....	
8,400	42,000	.012550	.010850	.010550	.010550	
8,600	43,000	.012900	.000250	.....	.....	
8,800	44,000	.013050	.000250	.....	.....	
9,000	45,000	.013600	.000550	.....	.....	Tensile strength.
9,200	46,000	.015000	.001400	.....	.....	
15,740	78,700	.....	.....	.....	.....	

General summary.

Tensile strength per square inch of original section .....	pounds..	78,700
Elastic limit per square inch of original section .....	do...	41,000
Elongation per inch after rupture .....	inch..	.1400
Elongation per inch under strain at elastic limit .....	do...	.001700
Reduction in diameter at point of rupture .....	do...	.045
Reduction in area after rupture, per cent of original section .....		16.9
Position of rupture .....		1'' from neck
Character of broken surface .....	granular, silky spot near the circumference	
Elongation of inch sections .....		"12" "16"



JACKET No. 12.

No. 4696.

Marks, <sup>86</sup>R<sub>1</sub>, J  
<sub>M T<sub>1</sub> I</sub>

Diameter, .505.

Sectional area, .20 square inch.

Gauged length, 2".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000100	.000100	0.	0.	
2,000	10,000	.000300	.000200	.....	.....	
4,000	20,000	.000700	.000400	.....	.....	
6,000	30,000	.001050	.000350	.....	.....	
8,000	40,000	.001400	.000350	0.	.....	
9,200	46,000	.001600	.000200	0.	.....	
9,400	47,000	.001650	.000050	.....	.....	
9,600	48,000	.001700	.000050	.....	.....	
9,800	49,000	.001750	.000050	.....	.....	
10,000	50,000	.001800	.000050	.....	.....	
10,200	51,000	.001900	.000100	.....	.....	
10,400	52,000	.001950	.000050	.....	.....	
10,600	53,000	.002000	.000050	.....	.....	
10,800	54,000	.002000	0.	.....	.....	
11,000	55,000	.002200	.000200	.....	.....	
11,200	56,000	.003000	.000800	.....	.....	
11,400	57,000	.004500	.001500	.....	.....	
11,600	58,000	.005750	.001250	.....	.....	
11,800	59,000	.007000	.001250	.....	.....	
12,520	97,600	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section .....	pounds..	97,600
Elastic limit per square inch of original section .....	do..	54,000
Elongation per inch after rupture .....	inch..	.205
Elongation per inch under strain at elastic limit .....	do..	.002000
Reduction in diameter at point of rupture .....	do..	.115
Reduction in area after rupture, per cent of original section .....	do..	46.8
Position of rupture .....	"	.75 from neck
Character of broken surface .....		silky
Elongation of inch sections .....	"	11, ".30"

## JACKET NO. 14.

No. 4708.

Marks, <sup>36</sup>R<sub>14</sub>J.  
 M T<sub>1</sub>I.  
 Diameter, <sup>11</sup>.505.  
 Sectional area, .20 square inch.  
 Gauged length, 2''.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000100	.000100	0.	0.	
2,000	10,000	.000400	.000300	.....	.....	
4,000	20,000	.000700	.000300	.....	.....	
6,000	30,000	.001050	.000350	.....	.....	
8,000	40,000	.001450	.000400	.000050	.000050	Elastic limit.
9,200	46,000	.001650	.000200	.000050	0.	
9,400	47,000	.001700	.000050	.....	.....	
9,600	48,000	.001750	.000050	.....	.....	
9,800	49,000	.001950	.000200	.....	.....	
10,000	50,000	.002400	.000450	.....	.....	
10,200	51,000	.003500	.001100	.....	.....	
10,400	52,000	.004500	.001000	.....	.....	
10,600	53,000	.005350	.000850	.....	.....	
18,940	94,700	.....	.....	.....	.....	

## General Summary.

Tensile strength per square inch of original section ..... pounds.. 94,700  
 Elastic limit per square inch of original section ..... do... 48,000  
 Elongation per inch after rupture ..... inch... .2250  
 Elongation per inch under strain at elastic limit ..... do... .001750  
 Reduction in diameter at point of rupture ..... do... .125  
 Reduction in area after rupture, per cent of original section ..... 43.3  
 Position of rupture ..... 1''.1 from neck  
 Character of broken surface ..... silky  
 Elongation of inch sections ..... "28" .17

JACKET No. 17.

No. 47163.

Marks, <sup>36</sup>R, <sup>J</sup>  
BT, O

Diameter, .505 square inch.

Sectional area, .20 square inch.

Gauged length, 2".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000100	.000100	0.	0.	
2,000	10,000	.000400	.000300	.....	.....	
4,000	20,000	.000850	.000250	.....	.....	
6,000	30,000	.001000	.000350	.....	.....	
8,000	40,000	.001400	.000400	0.	0.	
9,200	46,000	.001800	.000200	.000050	.000050	
9,400	47,000	.001850	.000050	.....	.....	
9,800	48,000	.001750	.000100	.....	.....	
9,800	49,000	.001800	.000050	.....	.....	
10,000	50,000	.002000	.000200	.....	.....	Elastic limit.
10,200	51,000	.002500	.000500	.....	.....	
10,400	52,000	.004100	.001600	.....	.....	
10,800	53,000	.005500	.001400	.....	.....	
10,800	53,000	.006000	.001100	.....	.....	
10,800	54,000	.007550	.000950	.....	.....	
17,610	88,050	.....	.....	.....	.....	

General summary.

Tensile strength per square inch of original section.....	pounds..	88,050
Elastic limit per square inch of original section.....	do...	49,000
Elongation per inch after rupture.....	inch..	.2400
Elongation per inch under strain at elastic limit.....	do...	.001800
Reduction in diameter at point of rupture.....	do...	.125
Reduction in area after rupture, per cent of original section.....	do...	43.3
Position of rupture.....	at middle of	stem
Character of broken surface.....	.....	silky
Elongation of inch sections.....	"22", "25"	





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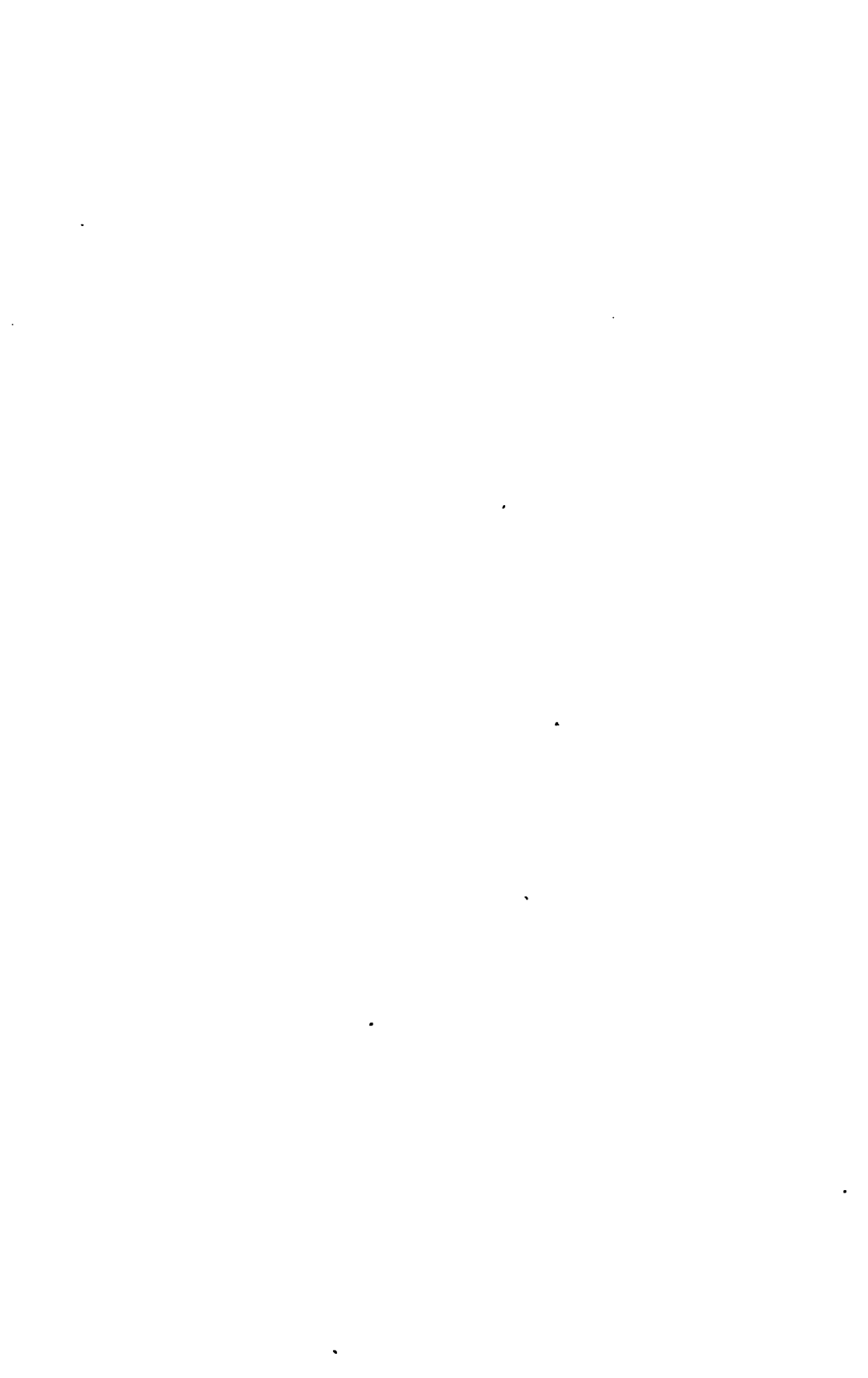
**3.6-INCH STEEL B. L. FIELD MORTARS.**

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**SPECIMENS FROM STEEL BODIES.**

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## BODY No. 6.

No. 4536.

Marks, <sup>36</sup>M, B

BT, M

Diameter, ".500.

Sectional area, .196 square inch.

Gauged length, 2".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
196	1,000	0.	0.	0.	0.	
850	5,000	.000100	.000100	0.	0.	
1,960	10,000	.000300	.000200	0.	0.	
3,920	20,000	.000800	.000300	0.	0.	
5,880	30,000	.001000	.000400	0.	0.	
6,860	35,000	.001150	.000150	0.	0.	
7,840	40,000	.001350	.000200	0.	0.	
8,232	42,000	.001450	.000100	0.	0.	
8,428	43,000	.001450	0.	0.	0.	
8,624	44,000	.001500	.000050	0.	0.	
8,820	45,000	.001500	0.	0.	0.	
9,016	46,000	.001550	.000050	0.	0.	
9,212	47,000	.001600	.000050	0.	0.	
9,408	48,000	.001600	0.	0.	0.	
9,604	49,000	.001650	.000050	0.	0.	
9,800	50,000	.001650	0.	0.	0.	
9,996	51,000	.001700	.000050	0.	0.	
10,192	52,000	.001750	.000050	0.	0.	
10,388	53,000	.001800	.000050	0.	0.	
10,584	54,000	.001900	.000100	0.	0.	
10,780	55,000	.001950	.000050	0.	0.	
10,976	56,000	.003250	.001300	0.	0.	
11,172	57,000	.005500	.002250	0.	0.	
11,368	58,000	.006100	.000800	0.	0.	
11,564	59,000	.007350	.001250	0.	0.	
11,760	60,000	.008100	.000750	0.	0.	
19,460	99,290	.....	.....	.....	.....	Tensile strength.

*General summary.*

Tensile strength per square inch of original section.....	pounds..	99,290
Elastic limit per square inch of original section.....	do..	55,000
Elongation per inch after rupture.....	inch..	.206
Elongation per inch under strain at elastic limit.....	do..	.001950
Reduction in diameter at point of rupture.....	do..	.110
Reduction in area after rupture, per cent of original section.....	.....	39.3
Position of rupture.....	1", 15 from neck	
Character of broken surface.....	silky	
Elongation of inch sections.....	" .23", "18	

BODY No. 16.

No. 4537.

Marks, <sup>36 M, B</sup><sub>B T, M</sub>

Diameter, <sup>11</sup>/<sub>16</sub> .502.

Sectional area, .198 square inch.

Gauged length, 2".

Applied loads.		Elongation per inch	Successive elongation per inch	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.	
198	1,000	0.	0.	0.	0.	Initial load.
990	5,000	.000100	.000100	0.	.....	
1,980	10,000	.000250	.000150	.....	.....	
2,970	20,000	.000550	.000300	.....	.....	
3,960	30,000	.000950	.000400	.....	.....	
4,950	35,000	.001050	.000100	0.	.....	
7,920	40,000	.001300	.000250	.....	.....	
8,316	42,000	.001350	.000050	0.	.....	
8,514	43,000	.001350	0.	.....	.....	
8,712	44,000	.001400	.000050	.....	.....	
8,910	45,000	.001450	.000050	.....	.....	
9,108	46,000	.001500	.000050	.....	.....	
9,306	47,000	.001500	0.	.....	.....	
9,504	48,000	.001550	.000050	.....	.....	
9,702	49,000	.001600	.000050	.....	.....	
9,900	50,000	.001600	0.	.....	.....	
10,098	51,000	.001650	.000050	.....	.....	
10,296	52,000	.001650	0.	.....	.....	
10,494	53,000	.001700	.000050	.....	.....	
10,692	54,000	.001800	.000100	.....	.....	
10,890	55,000	.001900	.000100	.....	.....	
11,088	56,000	.002600	.000700	.....	.....	
11,286	57,000	.003900	.001300	.....	.....	
11,484	58,000	.005350	.001450	.....	.....	
11,682	59,000	.008100	.000750	.....	.....	
11,880	60,000	.009900	.000800	.....	.....	
20,130	101,670	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength, per square inch of original section.....	pounds..	101,670
Elastic limit, per square inch of original section.....	do....	55,000
Elongation per inch after rupture.....	inch..	.190
Elongation per inch under strain at elastic limit.....	do....	.001900
Reduction in diameter at point of rupture.....	do....	.062
Reduction in area after rupture, per cent of original section.....		36.4
Position of rupture.....		" 9 from neck
Character of broken surface.....	silky, serrated, trace of granulation	
Elongation of inch sections.....		" 11, " 27"



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**5-INCH B. L. STEEL SIEGE RIFLES.**

**SPECIMENS FROM TUBE AND JACKET NO. 10,**

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## TUBE NO. 10.

No. 4,524.

Marks, <sup>S R, T</sup><sub>B T, M</sub>Diameter,  $\frac{1}{2}$ " .564.

Sectional area, .25 square inch.

Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000600	.000300	.....	.....	
7,500	30,000	.000933	.000333	.....	.....	
8,750	35,000	.001100	.000167	0.	.....	
10,000	40,000	.001267	.000167	.....	.....	
10,500	42,000	.001267	.000100	.000033	.000033	
10,750	43,000	.001400	.000033	.....	.....	
11,000	44,000	.001433	.000033	.....	.....	
11,250	45,000	.001467	.000034	.....	.....	Elastic limit.
11,500	46,000	.001600	.000133	.....	.....	
11,750	47,000	.001733	.000133	.....	.....	
12,000	48,000	.002100	.000367	.....	.....	
12,250	49,000	.003033	.000663	.....	.....	
12,500	50,000	.004367	.001334	.....	.....	Tensile strength.
22,480	89,920	.....	.....	.....	.....	

## General summary.

Tensile strength per square inch of original section.....	pounds..	89,920
Elastic limit per square inch of original section.....	do....	45,000
Elongation per inch after rupture.....	inch..	.2000
Elongation per inch under strain at elastic limit.....	do....	.001467
Reduction in diameter at point of rupture.....	do....	.134
Reduction in area after rupture, per cent of original section.....	do....	41.9
Position of rupture.....	.....	1 1/2" .65 from neck
Character of broken surface.....	.....	silky, 65 per cent; granular, 45 per cent
Elongation of inch sections.....	.....	" .12, " .55, " .13

## 5-INCH B. L. STEEL SIEGE RIFLES.

## JACKET NO. 10.

No. 4511.

Marks,  $\begin{matrix} 5 R_7, J \\ B T_1, M \end{matrix}$   
 Diameter, ".564.  
 Sectional area, .25 square inch.  
 Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	0.	
2,500	10,000	.000333	.000233	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
10,000	40,000	.001367	.000367	0.	.....	
11,000	44,000	.001467	.000100	0.	.....	
11,250	45,000	.001500	.000333	.....	.....	
11,500	46,000	.001567	.000067	.....	.....	
11,750	47,000	.001600	.000033	.....	.....	
12,000	48,000	.001600	.000200	.....	.....	
12,250	49,000	.003067	.001267	.....	.....	
12,500	50,000	.004667	.001600	.....	.....	
12,750	51,000	.005233	.000566	.....	.....	
13,000	52,000	.006067	.000834	.....	.....	
23,840	95,360	.....	.....	.....	.....	Tensile strength.

*General summary.*

Tensile strength per square inch of original section..... pounds.. 95,360  
 Elastic limit per square inch of original section..... do... 47,000  
 Elongation per inch after rupture..... inch... 2000  
 Elongation per inch under strain at elastic limit..... do... 001600  
 Reduction in diameter at point of rupture..... do... .124  
 Reduction in area after rupture, per cent of original section..... .. 39.2  
 Position of rupture..... 1".19 from neck  
 Character of broken surface..... silky  
 Elongation of inch sections..... ".15, ".26", ".19"

## 5-INCH B. L. STEEL SIEGE RIFLES.

*SPECIFIC GRAVITY AND HARDNESS OF TUBE AND JACKET NO. 10.*

No tension tests of these specimens.

Position in rifle.	Marks on specimens.	Specific gravity.	Hardness.
Tube.....	5 R <sub>10</sub> T-B R <sub>7</sub> M.....	7.8598	19.50
Jacket....	5 R <sub>10</sub> J-B R <sub>3</sub> M.....	7.8528	22.02

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**8-INCH STEEL B. L. RIFLES.**

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**SPECIMENS FROM TUBES AND JACKETS.**

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TUBE NO. 10.

No. 973.

Marks, <sup>8 R, T</sup><sub>B T<sub>10</sub> M</sub>  
Length, 5'".

Diameter, 1".102.

Sectional area, .953 square inch.

Gauged length, 4'".

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
853	1,000	0.	0.	0.	0.	
4,765	5,000	.000125	.000125	.....	.....	
9,530	10,000	.000250	.000125	.....	.....	
14,295	15,000	.000375	.000125	.....	.....	
19,060	20,000	.000500	.000175	.....	.....	
23,825	25,000	.000725	.000175	.....	.....	
28,590	30,000	.000875	.000150	.....	.....	
33,355	35,000	.001025	.000150	.....	.....	
38,120	40,000	.001225	.000200	.000025	.000025	
42,885	41,000	.001250	.000025	.....	.....	
47,650	42,000	.001275	.000025	.....	.....	
49,979	43,000	.001325	.000050	.....	.....	
41,982	44,000	.001975	.000050	.....	.....	
42,885	45,000	.004500	.002525	.003000	.002975	
43,838	46,000	.004950	.000450	.....	.....	
44,791	47,000	.005150	.000500	.....	.....	
45,744	48,000	.005350	.000700	.....	.....	
46,697	49,000	.005875	.000725	.....	.....	
47,650	50,000	.007500	.000625	.005825	.002825	
49,558	52,000	.008500	.001300	.....	.....	
51,462	54,000	.010225	.001425	.....	.....	
53,368	56,000	.011750	.001525	.....	.....	
55,274	58,000	.013500	.001750	.....	.....	
57,180	60,000	.014750	.001250	.....	.....	
59,086	62,000	.016225	.001475	.....	.....	
60,992	64,000	.017875	.001650	.....	.....	
62,898	66,000	.019775	.001900	.....	.....	
64,804	68,000	.021300	.001525	.....	.....	
66,710	70,000	.023100	.001800	.....	.....	
68,616	88,430	.....	.....	.....	.....	
						Ultimate strength.

Failed by triple flexure.

## TUBE NO. 22.

No. 956.

Marks,  $\frac{8}{B} \frac{E}{T} \frac{T}{M}$ 

Length, 5'.

Diameter, 1."128.

Sectional area, 1 square inch.

Gauged length, 4'.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
5,000	5,000	.000125	.000125	.....	.....	
10,000	10,000	.000250	.000125	.....	.....	
15,000	15,000	.000400	.000150	.....	.....	
20,000	20,000	.000550	.000150	.....	.....	
25,000	25,000	.000725	.000175	.....	.....	
30,000	30,000	.000875	.000150	0.	.....	
35,000	35,000	.001050	.000175	.....	.....	
40,000	40,000	.001200	.000150	0.	.....	
45,000	45,000	.001375	.000175	.....	.....	
46,000	46,000	.001425	.000050	.....	.....	
47,000	47,000	.001450	.000025	.....	.....	
48,000	48,000	.001500	.000050	.....	.....	
49,000	49,000	.001550	.000050	.....	.....	
50,000	50,000	.001600	.000050	.....	.....	
51,000	51,000	.001625	.000025	.....	.....	
52,000	52,000	.001725	.000100	.....	.....	
53,000	53,000	.001825	.000100	.....	.....	
54,000	54,000	.002150	.000325	.....	.....	
55,000	55,000	.002900	.000750	.....	.....	
56,000	56,000	.004150	.001250	.....	.....	
58,000	58,000	.005625	.001475	.....	.....	
60,000	60,000	.007250	.001625	.....	.....	
62,000	62,000	.008750	.001500	.....	.....	
64,000	64,000	.010100	.001350	.....	.....	
66,000	66,000	.011425	.001825	.....	.....	
68,000	68,000	.013125	.001700	.....	.....	
70,000	70,000	.014775	.001650	.....	.....	
72,000	72,000	.016275	.001500	.....	.....	
74,000	74,000	.017800	.001525	.....	.....	
76,000	76,000	.019525	.001725	.....	.....	
78,000	78,000	.021375	.001850	.....	.....	
107,720	107,720	.....	.....	.....	.....	U timate strength.

Failed by triple flexure

TUBE NO. 23.

No. 957.

Marks,  $\frac{8}{B} \frac{R}{T} \frac{M}{T}$

Length, 5'.

Diameter, 1".128.

Sectional area, 1 square inch.

Gauged length, 4'.

Applied loads.		Com- pression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
5,000	5,000	.000075	.000075	.....	.....	
10,000	10,000	.000225	.000150	.....	.....	
15,000	15,000	.000350	.000125	.....	.....	
20,000	20,000	.000500	.000150	.....	.....	
25,000	25,000	.000650	.000150	.....	.....	
30,000	30,000	.000800	.000150	0.	.....	
35,000	35,000	.000950	.000150	.....	.....	
40,000	40,000	.001100	.000150	0.	.....	
45,000	45,000	.001300	.000200	.....	.....	
46,000	46,000	.001350	.000050	.....	.....	
47,000	47,000	.001400	.000050	.....	.....	
48,000	48,000	.001475	.000075	.....	.....	
49,000	49,000	.001550	.000075	.....	.....	
50,000	50,000	.005825	.004275	.....	.....	
51,000	51,000	.006450	.006625	.....	.....	
52,000	52,000	.007125	.006675	.....	.....	
53,000	53,000	.007700	.006575	.....	.....	
54,000	54,000	.008425	.006725	.....	.....	
55,000	55,000	.009025	.006600	.....	.....	
56,000	56,000	.009875	.006850	.....	.....	
58,000	58,000	.011475	.001600	.....	.....	
60,000	60,000	.013000	.001525	.....	.....	
62,000	62,000	.014650	.001650	.....	.....	
64,000	64,000	.016375	.001725	.....	.....	
66,000	66,000	.018125	.001750	.....	.....	
68,000	68,000	.019900	.001675	.....	.....	
70,000	70,000	.021675	.001875	.....	.....	
100,570	100,570	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

H. Ex. 43—4

TUBE No. 24.

No. 958.

Marks,  $\frac{8 R M T}{B T M}$   
 Length, 5'.  
 Diameter, 1".128.  
 Sectional area, 1 square inch.  
 Gauged length, 4'.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
1,000	1,000	0.	0.	0.	0.	Initial load.
5,000	5,000	.000100	.000100	-----	-----	
10,000	10,000	.000250	.000150	-----	-----	
15,000	15,000	.000400	.000150	-----	-----	
20,000	20,000	.000550	.000150	-----	-----	
25,000	25,000	.000725	.000175	-----	-----	
30,000	30,000	.000925	.000200	.000025	.000025	
35,000	35,000	.001075	.000150	-----	-----	
40,000	40,000	.001250	.000175	.000025	0.	
45,000	45,000	.001425	.000175	-----	-----	
46,000	46,000	.001450	.000025	-----	-----	
47,000	47,000	.001500	.000050	-----	-----	Elastic limit.
48,000	48,000	.001750	.000250	-----	-----	
49,000	49,000	.003975	.002225	-----	-----	
50,000	50,000	.004875	.000900	-----	-----	
51,000	51,000	.005650	.000775	-----	-----	
52,000	52,000	.006375	.000725	-----	-----	
54,000	54,000	.007800	.001425	-----	-----	
56,000	56,000	.009525	.001725	-----	-----	
58,000	58,000	.011125	.001600	-----	-----	
60,000	60,000	.012700	.001575	-----	-----	
62,000	62,000	.014450	.001750	-----	-----	
64,000	64,000	.016050	.001600	-----	-----	
66,000	66,000	.017850	.001800	-----	-----	
68,000	68,000	.019825	.001975	-----	-----	
70,000	70,000	.021625	.001800	-----	-----	
103,100	103,100	-----	-----	-----	-----	Ultimate strength.

Failed by triple flexure.



JACKET NO. 9.

No. 4721.

Marks <sup>R, J</sup><sub>B, T, O</sub>

Diameter, ".564.

Sectional area, .25 square inch.

Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
250	1, 000	.0	.0	.0	.0	
1, 250	5, 000	.000067	.000067	.0	.....	
2, 500	10, 000	.000267	.000200	.....	.....	
5, 000	20, 000	.000600	.000333	.....	.....	
7, 500	30, 000	.000933	.000333	.....	.....	
10, 000	40, 000	.001267	.000334	.0	.....	
11, 000	44, 000	.001400	.000133	.000033	.000033	
11, 250	45, 000	.001433	.000033	.....	.....	
11, 500	46, 000	.001467	.000034	.....	.....	
11, 750	47, 000	.001500	.000033	.....	.....	
12, 000	48, 000	.001567	.000067	.....	.....	
12, 250	49, 000	.001633	.000066	.....	.....	
12, 500	50, 000	.001667	.000034	.....	.....	
12, 750	51, 000	.002000	.000333	.....	.....	
13, 000	52, 000	.003033	.001033	.....	.....	
13, 250	53, 000	.005700	.002667	.....	.....	
13, 500	54, 000	.007167	.001467	.....	.....	
13, 750	55, 000	.007833	.000666	.....	.....	
23, 080	92, 320	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section .....	pounds..	92, 320
Elastic limit per square inch of original section .....	do ..	50, 000
Elongation per inch after rupture .....	inch ..	.1933
Elongation per inch under strain at elastic limit .....	do ..	.001667
Reduction in diameter at point of rupture .....	do ..	.104
Reduction in area after rupture, per cent of original section .....		33.5
Position of rupture .....	" 90 from neck	
Character of broken surface .....	silky	
Elongation of inch sections .....	" 28", " 18", " 12	

No. 4722.

Marks, <sup>R, J</sup><sub>M, T, O</sub>  
 Diameter, ".564.  
 Sectional area, .25 square inch.  
 Gaged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	0.	
2,500	10,000	.000333	.000200	-----	-----	
5,000	20,000	.000667	.000334	-----	-----	
7,500	30,000	.001000	.000333	-----	-----	
10,000	40,000	.001367	.000367	.000033	.000033	
11,000	44,000	.001567	.000200	.000033	0.	
11,250	45,000	.001600	.000033	-----	-----	
11,500	46,000	.001633	.000033	-----	-----	
11,750	47,000	.001667	.000034	-----	-----	
12,000	48,000	.001667	0.	-----	-----	
12,250	49,000	.001700	.000033	-----	-----	Elastic limit.
12,500	50,000	.001767	.000067	-----	-----	
12,750	51,000	.007800	.006033	-----	-----	
13,000	52,000	.008933	.001133	-----	-----	
13,250	53,000	.009833	.000900	-----	-----	
13,500	54,000	.010667	.001134	-----	-----	
13,750	55,000	.012000	.001033	-----	-----	
21,170	84,680	-----	-----	-----	-----	

General summary.

Tensile strength per square inch of original section.....	pounds..	84,680
Elastic limit per square inch of original section.....	do...	50,000
Elongation per inch after rupture.....	inch..	.2333
Elongation per inch under strain at elastic limit.....	do...	.001767
Reduction in diameter at point of rupture.....	do...	.154
Reduction in area after rupture, per cent of original section.....		47.2
Position of rupture.....	"	7 from neck
Character of broken surface.....		silky
Elongation of inch sections.....	"	12, " 30, " 19

JACKET No. 21.

No. 959.

Marks, <sup>S R, J</sup><sub>B T, M</sub>  
Length, 5".

Diameter 1".127.

Sectional area, 1 square inch.

Gauged length, 4".

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
1,000	1,000	0.	0.	0.	0.	Initial load.
5,000	5,000	.000075	.000075	.....	.....	
10,000	10,000	.000225	.000150	.....	.....	
15,000	15,000	.000375	.000150	.....	.....	
20,000	20,000	.000550	.000175	.....	.....	
25,000	25,000	.000700	.000150	.....	.....	
30,000	30,000	.000875	.000175	0.	.....	
35,000	35,000	.001050	.000175	.....	.....	
40,000	40,000	.001200	.000150	.....	.....	
45,000	45,000	.001375	.000175	.....	.....	
50,000	50,000	.001575	.000200	.....	.....	Elastic limit.
51,000	51,000	.001650	.000075	.....	.....	
52,000	52,000	.001650	.000200	.....	.....	
53,000	53,000	.003125	.001275	.....	.....	
54,000	54,000	.003800	.000775	.....	.....	
55,000	55,000	.004575	.000675	.....	.....	
56,000	56,000	.005500	.000925	.....	.....	
58,000	58,000	.006750	.001250	.....	.....	
60,000	60,000	.008275	.001525	.....	.....	
62,000	62,000	.009550	.001275	.....	.....	
64,000	64,000	.011000	.001450	.....	.....	
66,000	66,000	.012350	.001350	.....	.....	
68,000	68,000	.014125	.001775	.....	.....	
70,000	70,000	.015450	.001325	.....	.....	
72,000	72,000	.016975	.001525	.....	.....	
74,000	74,000	.017575	.000600	.....	.....	
76,000	76,000	.020825	.002750	.....	.....	
78,000	78,000	.022375	.002050	.....	.....	
110,000	110,000	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

JACKET NO. 22.

No. 960.

Marks,  $\begin{smallmatrix} S & R & J \\ B & T & M \end{smallmatrix}$ 

Length, 5'.

Diameter, 1".128.

Sectional area, 1 square inch.

Gauged length, 4'.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
1,000	1,000	0.	0.	0.	0.	Initial load.
5,000	5,000	.000100	.000100			
10,000	10,000	.000250	.000150			
15,000	15,000	.000375	.000125			
20,000	20,000	.000525	.000150			
25,000	25,000	.000700	.000175			
30,000	30,000	.000875	.000175	0.		
35,000	35,000	.001025	.000150			
40,000	40,000	.001200	.000175			
45,000	45,000	.001375	.000175			
50,000	50,000	.001575	.000200	0.		Elastic limit.
51,000	51,000	.001850	.000075			
52,000	52,000	.001750	.000100			
53,000	53,000	.002175	.000425			
54,000	54,000	.002800	.000725			
55,000	55,000	.003775	.000875			
56,000	56,000	.004825	.000850			
58,000	58,000	.006300	.001675			
60,000	60,000	.007825	.001525			
62,000	62,000	.009175	.001350			
64,000	64,000	.010575	.001400			
66,000	66,000	.012050	.001475			
68,000	68,000	.013650	.001600			
70,000	70,000	.015200	.001550			
72,000	72,000	.016750	.001550			
74,000	74,000	.018475	.001725			
76,000	76,000	.020100	.001625			
78,000	78,000	.022000	.001900			
80,000	80,000	.023700	.001700			Ultimate strength.
109,980	109,980					

Failed by triple flexure.

## JACKET NO. 23.

No. 961.

Marks,  $\begin{smallmatrix} S R J \\ B T M \end{smallmatrix}$ 

Length, 5'.

Diameter, 1".129.

Sectional area, 1 square inch.

Gauged length, 4'.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
1,000	1,000	0.	0.	0.	0.	Initial load.
5,000	5,000	.000125	.000125	.....?	.....	
10,000	10,000	.000250	.000125	.....	.....	
15,000	15,000	.000400	.000150	.....	.....	
20,000	20,000	.000550	.000150	.....	.....	
25,000	25,000	.000750	.000200	.....	.....	
30,000	30,000	.000875	.000125	0.	.....	
35,000	35,000	.001050	.000175	.....	.....	
40,000	40,000	.001225	.000175	.....	.....	
45,000	45,000	.001400	.000175	.....	.....	
50,000	50,000	.001600	.000200	0.	.....	Elastic limit.
51,000	51,000	.001625	.000025	.....	.....	
52,000	52,000	.001750	.000125	.....	.....	
53,000	53,000	.002125	.000375	.....	.....	
54,000	54,000	.003325	.001200	.....	.....	
55,000	55,000	.004200	.000875	.....	.....	
56,000	56,000	.004975	.000775	.....	.....	
58,000	58,000	.008500	.001525	.....	.....	
60,000	60,000	.007775	.001275	.....	.....	
62,000	62,000	.008175	.001400	.....	.....	
64,000	64,000	.010500	.001325	.....	.....	
66,000	66,000	.011750	.001250	.....	.....	
68,000	68,000	.013300	.001550	.....	.....	
70,000	70,000	.014875	.001575	.....	.....	
72,000	72,000	.018250	.001375	.....	.....	
74,000	74,000	.017900	.001650	.....	.....	
76,000	76,000	.019150	.001250	.....	.....	
78,000	78,000	.020025	.001775	.....	.....	
80,000	80,000	.022900	.001975	.....	.....	Ultimate strength.
111,550	111,550	.....	.....	.....	.....	

Failed by triple flexure.

## 8-INCH STEEL B. L. RIFLES.

## 6-INCH STEEL B. L. RIFLES.

## SPECIFIC GRAVITY AND HARDNESS OF TUBES AND JACKETS.

No tension tests of these specimens.

Number of rifle.	Position in rifle.	Marks on specimen.	Specific gravity.	Hardness.
10	Tube .....	8 R <sub>10</sub> T-B R <sub>11</sub> M .....	7.8519	17.80
22	do .....	8 R <sub>22</sub> T-B R <sub>23</sub> M .....	7.8545	20.25
23	do .....	8 R <sub>23</sub> T-B R <sub>24</sub> M .....	7.8564	17.17
24	do .....	8 R <sub>24</sub> T-B R <sub>25</sub> M .....	7.8562	18.29
21	Jacket .....	8 R <sub>21</sub> J-B R <sub>14</sub> M .....	7.8556	20.61
22	do .....	8 R <sub>22</sub> J-B R <sub>25</sub> M .....	7.8374	19.60
23	do .....	8 R <sub>23</sub> J-B R <sub>16</sub> M .....	7.8570	20.70

## 8-INCH STEEL B. L. RIFLES.

## CHEMICAL COMPOSITION OF TUBES NOS. 22 AND 23, AND JACKET NO. 22.

Compression test number.	Number of rifle.	Position in rifle.	Carbon.			Manganese.	Silicon.	Sulphur.	Phosphorus.
			Total.	Graphitic.	Combined.				
956	22	Tube .....	0.230	0.010	0.220	0.662	0.149	0.030	0.024
957	23	do .....	0.233	0.009	0.223	0.662	0.157	0.024	0.020
960	22	Jacket .....	0.292	0.027	0.265	0.640	0.109	0.023	0.025

## TABULATION OF TENSION SPECIMENS FROM 8-INCH STEEL B. L. RIFLES.

[Stems 3 inches long, ".564 diameter.]

No. of test.	Position in gun.	Location of specimens.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation.	Contraction of area.	Appearance of fracture.
4721	Jacket No. 9 .....	Outside .....	<i>Pounds.</i> 50,000	<i>Pounds.</i> 92,320	<i>Per ct.</i> 19.3	<i>Per ct.</i> 33.5	Silky.*
4722	do .....	do .....	50,000	84,680	23.3	47.2	Do.†

\* Breech end.

† Muzzle end.

## TABULATION OF COMPRESSION SPECIMENS FROM 8-INCH STEEL B. L. RIFLES.

No. of test.	Position in gun.	Location of specimens.	Elastic limit per square inch.	Ultimate strength per square inch.	Manner of failure.
973	Tube No. 10 .....	Middle .....	<i>Pounds.</i> 43,000	<i>Pounds.</i> 98,430	Triple flexure.*
956	Tube No. 22 .....	do .....	49,000	107,720	Do.*
957	Tube No. 23 .....	do .....	49,000	100,570	Do.*
958	Tube No. 24 .....	do .....	47,000	103,100	Do.*
959	Jacket No. 21 .....	do .....	51,000	110,300	Do.*
960	Jacket No. 22 .....	do .....	51,000	109,980	Do.*
961	Jacket No. 23 .....	do .....	51,000	111,550	Do.*

\* Breech end.

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**10-INCH STEEL B. L. RIFLES.**

**SPECIMENS FROM TUBES AND JACKETS.**

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TUBE NO. 4.

No. 4534.

Marks, <sup>10 R, T</sup><sub>B T, M</sub>

Diameter, <sup>1</sup>/<sub>100</sub> .565.

Sectional area, .25 square inch.

Gauged length, 3'.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
250	1,000	0.	0.	0.	0.	
1,250	5,000	.000100	.000100	0.	0.	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.001000	.000367	.....	.....	
8,750	35,000	.001133	.000133	0.	0.	
10,000	40,000	.001333	.000200	.000033	.000033	
10,250	41,000	.001267	.000034	.....	.....	
10,500	42,000	.001400	.000033	.....	.....	
10,750	43,000	.001433	.000033	.....	.....	
11,000	44,000	.001467	.000034	.....	.....	
11,250	45,000	.001500	.000033	.....	.....	
11,500	46,000	.001533	.000033	.....	.....	
11,750	47,000	.001600	.000067	.....	.....	
12,000	48,000	.001667	.000067	.....	.....	
12,250	49,000	.002067	.000400	.....	.....	
12,500	50,000	.002733	.000666	.....	.....	
12,750	51,000	.003233	.000500	.....	.....	
13,000	52,000	.004000	.000767	.....	.....	
13,250	53,000	.005033	.001033	.....	.....	
23,750	95,000	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section.....	pounds..	95,000
Elastic limit per square inch of original section.....	do..	48,000
Elongation per inch after rupture.....	inch..	.1967
Elongation per inch under strain at elastic limit.....	do..	.001667
Reduction in diameter at point of rupture.....	do..	.104
Reduction in area after rupture, per cent of original section.....		33.5
Position of rupture.....		1".10 from neck
Character of broken surface.....		granular, 75 per cent; silky, 25 per cent
Elongation of inch sections.....		" .21", ".20", ".12

No. 990.

Marks, <sup>10 R, T</sup>  
<sub>B T, M</sub>  
 Length, 5'.  
 Diameter, 1".127.  
 Sectional area, 1 square inch.  
 Gauged length, 4'.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
1,000	1,000	0.	0.	0.	0.	Initial load.
5,000	5,000	.000100	.000100	.....	.....	
10,000	10,000	.000250	.000150	.....	.....	
15,000	15,000	.000425	.000175	.....	.....	
20,000	20,000	.000625	.000200	.....	.....	
25,000	25,000	.000775	.000150	.....	.....	
30,000	30,000	.000925	.000150	.....	.....	
35,000	35,000	.001100	.000175	0.	.....	
40,000	40,000	.001250	.000150	0.	.....	
41,000	41,000	.001300	.000050	.....	.....	
42,000	42,000	.001325	.000025	.....	.....	
43,000	43,000	.001350	.000025	.....	.....	
44,000	44,000	.001375	.000025	.....	.....	
45,000	45,000	.001425	.000050	.....	.....	
46,000	46,000	.001450	.000025	.....	.....	
47,000	47,000	.001500	.000050	.....	.....	
48,000	48,000	.001550	.000050	.....	.....	
49,000	49,000	.001600	.000050	.....	.....	
50,000	50,000	.001650	.000050	.000025	.000025	Elastic limit.
51,000	51,000	.001975	.000325	.....	.....	
52,000	52,000	.002450	.000475	.....	.....	
53,000	53,000	.003125	.000675	.....	.....	
54,000	54,000	.003650	.000525	.....	.....	
56,000	56,000	.005300	.001650	.....	.....	
58,000	58,000	.006825	.001525	.....	.....	
60,000	60,000	.008400	.001575	.006125	.006100	
62,000	62,000	.009525	.001125	.....	.....	
64,000	64,000	.010950	.001425	.....	.....	
66,000	66,000	.012800	.001850	.....	.....	
68,000	68,000	.014275	.001475	.....	.....	
70,000	70,000	.015875	.001600	.013150	.007025	
102,200	102,200	.....	.....	.....	.....	Ultimate strength.

Failed by double flexure.

No. 4533.

Marks, <sup>10 R, T</sup><sub>M T, M</sub>  
 Diameter, <sup>10</sup>/<sub>16</sub> .565.  
 Sectional area, .25 square inch.  
 Gauged length, 3''.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
250	1,000	.0	.0	.0	.0	
1,250	5,000	.000100	.000100	.0	.0	
2,500	10,000	.000267	.000167	.0	.0	
5,000	20,000	.000600	.000333			
7,500	30,000	.000823	.000333			
8,750	35,000	.001100	.000167			
10,000	40,000	.001267	.000167	.0		
10,250	41,000	.001300	.000033	.0		
10,500	42,000	.001323	.000033			
10,750	43,000	.001267	.000034			
11,000	44,000	.001400	.000033			
11,250	45,000	.001433	.000033			
11,500	46,000	.001500	.000067			
11,750	47,000	.001533	.000033			
12,000	48,000	.001600	.000067			
12,250	49,000	.003667	.002067			
12,500	50,000	.005167	.001500			
12,750	51,000	.005667	.000500			
13,000	52,000	.006600	.000633			
13,250	53,000	.007400	.000800			
23,210	92,840					Tenstile strength.

General summary.

Tensile strength per square inch of original section .....	pounds..	92,840
Elastic limit per square inch of original section .....	do...	48,000
Elongation per inch after rupture .....	inch...	.1867
Elongation per inch under strain at elastic limit .....	do...	.001600
Reduction in diameter at point of rupture .....	do...	.135
Reduction in area after rupture, per cent of original section .....		41.9
Position of rupture .....	1" .5 from the neck	
Character of broken surface .....	silky	
Elongation of inch sections .....	" .13, ".31, ".12	

## TUBE NO. 5.

No. 991.

Marks, <sup>10 R, T.</sup>  
<sub>R T, M.</sub>

Length, 5''.

Diameter, 1'' .126.

Sectional area, .0996 square inch.

Gauged length, 4''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
996	1,000	0.	0.	0	0.	Initial load.
4,960	5,000	.000100	.000100	0	.....	
9,960	10,000	.000200	.000100	.....	.....	
14,940	15,000	.000350	.000150	.....	.....	
19,920	20,000	.000500	.000150	.....	.....	
24,900	25,000	.000650	.000150	.....	.....	
29,880	30,000	.000800	.000150	.....	.....	
34,860	35,000	.000975	.000175	.....	.....	
39,840	40,000	.001200	.000225	.000075	.000075	
40,836	41,000	.001250	.000050	.....	.....	
41,832	42,000	.001300	.000050	.....	.....	
42,828	43,000	.001375	.000075	.....	.....	Elastic limit.
43,824	44,000	.001475	.000100	.....	.....	
44,820	45,000	.001675	.000200	.....	.....	
45,816	46,000	.002175	.000500	.....	.....	
46,812	47,000	.003350	.001175	.....	.....	
47,808	48,000	.004475	.001125	.....	.....	
48,804	49,000	.005250	.000775	.....	.....	
49,800	50,000	.006150	.000900	.004500	.001425	
51,792	52,000	.007625	.001475	.....	.....	
53,784	54,000	.009025	.001400	.....	.....	
55,776	56,000	.010700	.001675	.....	.....	
57,768	58,000	.012475	.001775	.....	.....	
59,760	60,000	.014025	.001550	.012000	.007500	
61,752	62,000	.015700	.001675	.....	.....	
63,744	64,000	.017450	.001750	.....	.....	
65,736	66,000	.019625	.002175	.....	.....	
67,728	68,000	.021750	.002125	.....	.....	
69,720	70,000	.023525	.001775	.021125	.006125	
94,860	95,280	.....	.....	.....	.....	Ultimate strength.

Failed by double flexure.

TUBE NO. 6.

No. 974.

Marks, <sup>10 R, T</sup><sub>B T, M</sub> .  
 Length, 5''.

Diameter, 1'' .127.

Sectional area, 1 square inch.

Gauged length, 4''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
5,000	5,000	.000125	.000125	0.	0.	
10,000	10,000	.000250	.000125	.....	.....	
15,000	15,000	.000400	.000150	.....	.....	
20,000	20,000	.000550	.000150	.....	.....	
25,000	25,000	.000725	.000175	.....	.....	
30,000	30,000	.000900	.000175	.....	.....	
35,000	35,000	.001075	.000175	0.	.....	
40,000	40,000	.001275	.000200	.000025	.000025	
41,000	41,000	.001300	.000025	.....	.....	
42,000	42,000	.001325	.000025	.....	.....	
43,000	43,000	.001375	.000050	.....	.....	
44,000	44,000	.001400	.000025	.....	.....	
45,000	45,000	.001425	.000025	.000025	0.	
46,000	46,000	.001475	.000050	.....	.....	
47,000	47,000	.001500	.000025	.....	.....	
48,000	48,000	.001550	.000050	.....	.....	
49,000	49,000	.001575	.000025	.....	.....	
50,000	50,000	.001625	.000050	.000050	.000025	
51,000	51,000	.003000	.001375	.....	.....	
52,000	52,000	.003875	.000875	.....	.....	
53,000	53,000	.004550	.000875	.....	.....	
54,000	54,000	.005175	.000625	.....	.....	
56,000	56,000	.006575	.001400	.....	.....	
58,000	58,000	.008250	.001675	.....	.....	
60,000	60,000	.009700	.001450	.....	.....	
62,000	62,000	.011200	.001500	.....	.....	
64,000	64,000	.012500	.001300	.....	.....	
66,000	66,000	.014000	.001500	.....	.....	
68,000	68,000	.015825	.001825	.....	.....	
70,000	70,000	.017550	.001725	.....	.....	Ultimate strength.
108,400	108,400	.....	.....	.....	.....	

Failed by triple flexure.

## TUBE NO. 7.

No. 4583

Marks, <sup>10 R, T</sup><sub>BT, M</sub>

Diameter, ".566.

Sectional area, .252 square inch.

Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
252	1,000	0.	0.	0.	0.	
1,260	5,000	.000067	.000067	0.	0.	
2,520	10,000	.000267	.000200	.....	.....	
5,040	20,000	.000567	.000300	.....	.....	
7,560	30,000	.000900	.000333	.....	.....	
8,820	35,000	.001067	.000167	0.	.....	
10,080	40,000	.001233	.000166	0.	.....	
10,332	41,000	.001267	.000034	.....	.....	
10,584	42,000	.001300	.000033	.....	.....	
10,836	43,000	.001333	.000033	.....	.....	
11,088	44,000	.001367	.000034	.....	.....	
11,340	45,000	.001400	.000033	.....	.....	
11,592	46,000	.001433	.000033	.....	.....	
11,844	47,000	.001467	.000034	.....	.....	
12,096	48,000	.001500	.000100	.....	.....	
12,348	49,000	.002400	.000633	.....	.....	
12,600	50,000	.006933	.001533	.....	.....	
12,852	51,000	.004533	.000600	.....	.....	
13,104	52,000	.005633	.001400	.....	.....	
26,220	92,140	.....	.....	.....	.....	

## General summary.

Tensile strength per square inch of original section .....	pounds..	92,140
Elastic limit per square inch of original section .....	do..	47,000
Elongation per inch after rupture .....	inch..	.2267
Elongation per inch under strain at elastic limit .....	do..	.001467
Reduction in diameter at point of rupture .....	do..	.146
Reduction in area after rupture, per cent of original section .....	.....	45.0
Position of rupture .....	1".6 from neck	
Character of broken surface .....	alky	
Elongation of inch sections .....	"14, "38", "18	

No. 999.

Marks, <sup>10 R, T</sup>  
B T, M

Length, 5''.

Diameter, 1'' .126.

Sectional area, 1 square inch.

Gauged length, 4''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0.	.0	.0		
5,000	5,000	.000100	.000100	.....	.....		
10,000	10,000	.000250	.000150	.....	.....		
15,000	15,000	.000375	.000125	.....	.....		
20,000	20,000	.000525	.000150	.....	.....		
25,000	25,000	.000675	.000150	.....	.....		
30,000	30,000	.000825	.000150	.....	.....		
35,000	35,000	.000975	.000150	.....	.....		
40,000	40,000	.001150	.000175	.000025	.000025		
41,000	41,000	.001200	.000650	.....	.....		
42,000	42,000	.001250	.000650	.....	.....		
43,000	43,000	.001275	.000025	.....	.....		
44,000	44,000	.001300	.000025	.....	.....		
45,000	45,000	.001325	.000025	.....	.....		
46,000	46,000	.001400	.000075	.....	.....		
47,000	47,000	.001450	.000050	.....	.....		
48,000	48,000	.001500	.000050	.....	.....		
49,000	49,000	.001625	.000125	.....	.....		
50,000	50,000	.002325	.000700	.....	.....		
51,000	51,000	.004050	.001725	.....	.....		
52,000	52,000	.004875	.000825	.....	.....		
54,000	54,000	.006025	.001750	.....	.....		
56,000	56,000	.008275	.001650	.....	.....		
58,000	58,000	.009750	.001475	.....	.....		
60,000	60,000	.011400	.001650	.....	.....		
62,000	62,000	.013050	.001650	.....	.....		
64,000	64,000	.014975	.001625	.....	.....		
66,000	66,000	.016200	.001525	.....	.....		
68,000	68,000	.018125	.001925	.....	.....		
70,000	70,000	.019875	.001750	.....	.....		
102,800	102,800	.....	.....	.....	.....		Ultimate strength.

Failed by triple flexure.

Hx. Ex. 43—5

No. 4582.

Marks, <sup>10 R, T</sup>  
<sub>M T, M</sub>  
 Diameter, ".565.  
 Sectional area, .251 square inch.  
 Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
251	1,000	0.	0.	0.	0.	
1,255	5,000	.000067	.000067	0.	.....	Initial load.
2,510	10,000	.000267	.000200	.....	.....	
5,020	20,000	.000633	.000366	.....	.....	
7,530	30,000	.000967	.000334	.....	.....	
8,785	35,000	.001100	.000133	0.	.....	
10,040	40,000	.001300	.000200	0.	.....	
10,291	41,000	.001333	.000233	.....	.....	
10,542	42,000	.001367	.000284	.....	.....	
10,793	43,000	.001400	.000083	.....	.....	
11,044	44,000	.001433	.000083	.....	.....	Elastic limit.
11,295	45,000	.001733	.000300	.....	.....	
11,546	46,000	.002067	.000334	.....	.....	
11,797	47,000	.002333	.000266	.....	.....	
12,048	48,000	.005267	.002934	.....	.....	
12,299	49,000	.008567	.001300	.....	.....	
22,430	89,360	.....	.....	.....	.....	Tensile strength.

*General summary.*

Tensile strength per square inch of original section.....pounds.. 89,360  
 Elastic limit per square inch of original section.....do... 44,000  
 Elongation per inch after rupture.....inch... .2333  
 Elongation per inch under strain at elastic limit.....do... .001433  
 Reduction in diameter at point of rupture.....do... .155  
 Reduction in area after rupture, per cent of original section.....do... 47.4  
 Position of rupture.....".9 from neck  
 Character of broken surface.....silky  
 Elongation of inch section.....".12," .16," .26"



TUBE No. 8.

No. 1000.

Marks, <sup>10 R, T</sup>  
B T, M

Length, 5'.

Diameter, 1".128.

Sectional area, 1 square inch.

Gauged length, 4'.

Applied loads.		Compre- sion per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
0.	0.	0.	0.	0.	0.	
1,000	1,000	.000125	.000125	.....	.....	Elastic limit.
5,000	5,000	.000250	.000150	.....	.....	
10,000	10,000	.000375	.000125	.....	.....	
15,000	15,000	.000525	.000150	.....	.....	
20,000	20,000	.000675	.000150	.....	.....	
25,000	25,000	.000875	.000200	.....	.....	
30,000	30,000	.001000	.000125	.....	.....	
35,000	35,000	.001150	.000150	.000025	.000015	
40,000	40,000	.001175	.000025	.....	.....	
41,000	41,000	.001225	.000050	.....	.....	
42,000	42,000	.001250	.000025	.....	.....	
43,000	43,000	.001275	.000025	.....	.....	
44,000	44,000	.001300	.000025	.....	.....	
45,000	45,000	.001325	.000025	.....	.....	
46,000	46,000	.001375	.000050	.....	.....	
47,000	47,000	.001425	.000050	.....	.....	
48,000	48,000	.001475	.000050	.....	.....	
49,000	49,000	.001850	.000175	.....	.....	
50,000	50,000	.002125	.000475	.....	.....	
51,000	51,000	.003225	.001100	.....	.....	
52,000	52,000	.004950	.001725	.....	.....	
54,000	54,000	.006300	.001350	.....	.....	
56,000	56,000	.007750	.001450	.....	.....	
58,000	58,000	.009000	.001250	.....	.....	
60,000	60,000	.010575	.001575	.....	.....	
62,000	62,000	.012200	.001625	.....	.....	
64,000	64,000	.013500	.001300	.....	.....	
66,000	66,000	.014950	.001450	.....	.....	
68,000	68,000	.016525	.001575	.....	.....	
70,000	70,000	.....	.....	.....	.....	Ultimate strength.
106,400	106,400	.....	.....	.....	.....	

Failed by triple flexure.

## TUBE No. 10.

No. 4609.

Marks, <sup>10 R, T</sup><sub>B T, M</sub>Diameter,  $\frac{1}{2}$ " .563.

Sectional area, .25 square inch.

Gauged length, 3'.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
250	1,000	0.	0.	0.	0.	
1,250	5,000	.000100	.000100	0.	0.	
2,500	10,000	.000333	.000233			
5,000	20,000	.000633	.000300			
7,500	30,000	.001000	.000867			
8,750	35,000	.001133	.000133	.000033	.000033	
10,000	40,000	.001400	.000267	.000067	.000034	
10,250	41,000	.001433	.000033			
10,500	42,000	.001500	.000067			
10,750	43,000	.001533	.000033			
11,000	44,000	.001567	.000034			
11,250	45,000	.001633	.000066			
11,500	46,000	.001667	.000034			
11,750	47,000	.001700	.000033			
12,000	48,000	.001767	.000067			
12,250	49,000	.003667	.001900			
12,500	50,000	.004667	.001000			
12,750	51,000	.005067	.000400			
13,000	52,000	.006233	.001167			
13,250	53,000	.007200	.000967			
23,980	91,920					Tensile strength.

*General summary.*

Tensile strength per square inch of original section .....	pounds..	91,920
Elastic limit per square inch of original section .....	do..	48,000
Elongation per inch after rupture .....	inch..	.2167
Elongation per inch under strain at elastic limit .....	do..	.001767
Reduction in diameter at point of rupture .....	do..	.133
Reduction in area after rupture, per cent of original section .....		41.9
Position of rupture .....		at middle of stem
Character of broken surface .....		silky, serrated
Elongation of inch sections .....		" .18, ".36", ".11

No. 4608.

Marks, <sup>10 R, T</sup><sub>MT, M</sub>  
 Diameter, <sup>11</sup>/<sub>16</sub> .563.  
 Sectional area, .25 square inch.  
 Gauged length, 3'.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
250	1,000	0.	0.	0.	0.	
1,250	5,000	.000067	.000067	0.	0.	
2,500	10,000	.000233	.000166	0.	0.	
5,000	20,000	.000800	.000367	0.	0.	
7,500	30,000	.000900	.000300	0.	0.	
8,750	35,000	.001100	.000200	0.	0.	
10,000	40,000	.001267	.000167	0.	0.	
10,250	41,000	.001300	.000033	0.	0.	
10,500	42,000	.001333	.000033	0.	0.	
10,750	43,000	.001367	.000034	0.	0.	Elastic limit.
11,000	44,000	.001433	.000968	0.	0.	
11,250	45,000	.001467	.000034	0.	0.	
11,500	46,000	.001500	.000033	0.	0.	
11,750	47,000	.001533	.000033	0.	0.	
12,000	48,000	.001567	.000034	0.	0.	
12,250	49,000	.001600	.000834	0.	0.	
12,500	50,000	.001633	.000033	0.	0.	
12,750	51,000	.005333	.003700	0.	0.	
13,000	52,000	.006333	.001900	0.	0.	
13,250	53,000	.007167	.000834	0.	0.	Tensile strength.
13,500	54,000	.008267	.001100	0.	0.	
13,750	55,000	.009167	.000900	0.	0.	
22,490	89,960	.....	.....	.....	.....	

General summary.

Tensile strength per square inch of original section .....	pounds..	89,960
Elastic limit per square inch of original section .....	do ..	50,000
Elongation per inch after rupture .....	inch ..	.210
Elongation per inch under strain at elastic limit .....	do ..	.001633
Reduction in diameter at point of rupture .....	do ..	.123
Reduction in area after rupture, per cent of original section .....		39.2
Position of rupture .....	1" from neck	
Character of broken fracture .....	granular, 60 per cent; silky, 40 per cent	
Elongation of inch sections .....	7, 13, 18, 23"	

## TUBE NO. 15.

No. 4617.

Marks, <sup>10 R, T</sup><sub>B T, M</sub>

Diameter, ".564.

Sectional area, .25 square inch.

Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
250	1,000	0.	0.	0.	0.	Initial load
1,250	5,000	.000167	.000167	0.	0.	
2,500	10,000	.000400	.000233	.....	.....	
5,000	20,000	.000700	.000300	.....	.....	
7,500	30,000	.001067	.000367	.....	.....	
8,750	35,000	.001233	.000166	.000033	.000033	
10,000	40,000	.001400	.000167	.000033	0.	
10,250	41,000	.001432	.000033	.....	.....	
10,500	42,000	.001467	.000034	.....	.....	
10,750	43,000	.001500	.000033	.....	.....	
11,000	44,000	.001567	.000067	.....	.....	
11,250	45,000	.001600	.000033	.....	.....	
11,500	46,000	.001633	.000033	.....	.....	
11,750	47,000	.001667	.000034	.....	.....	
12,000	48,000	.001733	.000066	.....	.....	
12,250	49,000	.001833	.000100	.....	.....	
12,500	50,000	.002167	.000334	.....	.....	
12,750	51,000	.002267	.001100	.....	.....	
13,000	52,000	.004133	.008666	.....	.....	
13,250	53,000	.005067	.009334	.....	.....	
24,140	96,560	.....	.....	.....	.....	Tensile strength.

*General summary.*

Tensile strength per square inch of original section .....	pounds..	96,560
Elastic limit per square inch of original section .....	do.....	48,000
Elongation per inch after rupture .....	inch..	.1867
Elongation per inch under strain at elastic limit.....	do.....	.001733
Reduction in diameter at point of rupture .....	do.....	.114
Reduction in area after rupture, per cent of original section.....	.....	36.4
Position of rupture.....	at middle of stem	
Character of broken surface.....	silky, serrated	
Elongation of inch sections.....	" 13, " 31, " 12	

No. 4616.

Marks, <sup>10</sup>R, <sup>T</sup>  
<sub>M</sub> <sup>T</sup>, <sub>M</sub>

Diameter, <sup>11</sup>/<sub>16</sub> 564.

Sectional area, .25 square inch.

Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	0.	
2,500	10,000	.000333	.000200			
5,000	20,000	.000667	.000334			
7,500	30,000	.000967	.000300			
8,750	35,000	.001200	.000233	0.		
10,000	40,000	.001367	.000167	0.		
10,250	41,000	.001433	.000106			
10,500	42,000	.001500	.000067			
10,750	43,000	.001533	.000033			
11,000	44,000	.001567	.000034			Elastic limit.
11,250	45,000	.001600	.000033			
11,500	46,000	.001667	.000067			
11,750	47,000	.001700	.000233			
12,000	48,000	.002300	.000400			
12,250	49,000	.003167	.000667			Tensile strength.
12,500	50,000	.004500	.001333			
12,750	51,000	.005667	.001167			
23,110	92,440					

*General summary.*

Tensile strength per square inch of original section .....	pounds..	92.440
Elastic limit per square inch of original section.....	do...	46,000
Elongation per inch after rupture.....	inch..	.1333
Elongation per inch under strain at elastic limit .....	do...	.001667
Reduction in diameter at point of rupture.....	do...	.044
Reduction in area after rupture, per cent of original section.....		15.0
Position of rupture .....		.7 from neck
Character of broken surface .....	granular, flaky spot at circumference	
Elongation of inch sections .....		".10, ".12, ".18"

## TUBE No. 16.

No. 4680.

Marks, <sup>10 R, T</sup><sub>B T, M</sub>

Diameter ".564.

Sectional area .25 square inch.

Gauged, length, 3'.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>		
250	1,000	0.	0.	0.	0.	Initial load.	
1,250	5,000	.000067	.000067	0.	.....		
2,500	10,000	.000300	.000233	.....	.....		
5,000	20,000	.000633	.000333	.....	.....		
7,500	30,000	.000967	.000334	.....	.....		
8,750	35,000	.001100	.000133	0.	.....		
10,000	40,000	.001333	.000233	0.	.....		
10,250	41,000	.001333	0.	.....	.....		
10,500	42,000	.001367	.000034	.....	.....		
10,750	43,000	.001400	.000033	.....	.....		
11,000	44,000	.001433	.000033	.....	.....	Elastic limit.	
11,250	45,000	.001500	.000067	.....	.....		
11,500	46,000	.005000	.003500	.....	.....		
11,750	47,000	.006667	.001667	.....	.....		
12,000	48,000	.007333	.000666	.....	.....		
12,250	49,000	.008333	.001000	.....	.....		
12,500	50,000	.009333	.001000	.....	.....		
21,810	85,240	.....	.....	.....	.....		Tensile strength.

*General summary.*

Tensile strength per square inch of original section .....	pounds ..	85,240
Elastic limit per square inch of original section .....	do ..	45,000
Elongation per inch after rupture .....	inches ..	.2433
Elongation per inch under strain at elastic limit .....	do ..	.001500
Deduction in diameter at point of rupture .....	do ..	.174
Reduction in area after rupture, per cent of original section .....		52.2
Position of rupture .....	1".5 from neck.	
Character of broken surface .....	silky	
Elongation of inch sections .....	" .13, " .39, " .21	

No. 4679.

Marks, <sup>10 R, T</sup><sub>M T, M</sub>  
 Diameter, <sup>1</sup>/<sub>16</sub> .564.  
 Sectional area, .25<sup>5</sup> square inch.  
 Gauged length, 3<sup>1</sup>/<sub>2</sub>.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
250	1,000	0.	0.	0.	0.	
1,250	5,000	.000100	.000100	0.	0.	
2,500	10,000	.000333	.000233	-----	-----	
5,000	20,000	.000667	.000334	-----	-----	
7,500	30,000	.001000	.000333	-----	-----	
8,750	35,000	.001167	.000167	0.	-----	
10,000	40,000	.001333	.000166	0.	-----	
10,250	41,000	.001367	.000034	-----	-----	
10,500	42,000	.001400	.000033	-----	-----	
10,750	43,000	.001433	.000032	-----	-----	
11,000	44,000	.001467	.000034	-----	-----	
11,250	45,000	.001533	.000066	-----	-----	
11,500	46,000	.001600	.000067	-----	-----	
11,750	47,000	.001667	.000067	-----	-----	
12,000	48,000	.001700	.000033	-----	-----	
12,250	49,000	.001733	.000033	-----	-----	
12,500	50,000	.004000	.002267	-----	-----	
12,750	51,000	.007300	.003300	-----	-----	
13,000	52,000	.007833	.000533	-----	-----	
13,250	53,000	.008333	.000500	-----	-----	
13,500	54,000	.008333	.001000	-----	-----	
22,710	90,840	-----	-----	-----	-----	Tensile strength.

General summary.

Tensile strength per square inch of original section .....	pounds..	90,840
Elastic limit per square inch of original section .....	do ..	49,000
Elongation per inch after rupture .....	inch ..	.2100
Elongation per inch under strain at elastic limit .....	do ..	.001733
Reduction in diameter at point of rupture .....	do ..	.144
Reduction in area after rupture, per cent of original section .....		44.6
Position of rupture .....	1 <sup>1</sup> / <sub>2</sub> from neck	
Character of broken surface .....	silky	
Elongation of inch sections .....	" .12, " .19, " .32"	

JACKET NO. 3.

No. 4513.

Marks, <sup>10</sup>R, J  
BT, M

Diameter, <sup>11</sup>.565.

Sectional area, .25 square inch.

Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
250	1,000	0.	0.	0.	0.	
1,250	5,000	.000067	.000067	0.		
2,500	10,000	.000267	.000200			
5,000	20,000	.000600	.000333			
7,500	30,000	.000933	.000333			
8,750	35,000	.001067	.000134	0.		
10,000	40,000	.001267	.000200			
10,500	42,000	.001300	.000033	0.		
10,750	43,000	.001333	.000033			
11,000	44,000	.001367	.000034			
11,250	45,000	.001400	.000033			
11,500	46,000	.001433	.000033			
11,750	47,000	.001433	0.			
12,000	48,000	.001500	.000067			
12,250	49,000	.001533	.000033			
12,500	50,000	.001567	.000034			
12,750	51,000	.001600	.000033			
13,000	52,000	.001633	.000033			
13,250	53,000	.001700	.000067			
13,500	54,000	.001733	.000033			
13,750	55,000	.002000	.000267			
14,000	56,000	.003167	.001167			
14,250	57,000	.003600	.000433			
14,500	58,000	.004600	.001000			
14,750	59,000	.004933	.000333			
26,310	105,240					Tensile strength.

General summary.

Tensile strength per square inch of original section .....	pounds..	105,240
Elastic limit per square inch of original section .....	do...	54,000
Elongation per inch after rupture .....	inch..	.1800
Elongation per inch under strain at elastic limit .....	do...	.001733
Reduction in diameter at point of rupture .....	do...	.065
Reduction in area after rupture, per cent of original section .....		21.4
Position of rupture .....		1". 6 from neck
Character of broken surface .....	granular, radiating from a point in the circumference	
Elongation of inch sections .....		"12, "22", "14



No. 975.

Marks, <sup>10 R. J.</sup>  
<sup>B T. M.</sup>  
Length, 5'.

Diameter, 1".103.

Sectional area, .956 square inch.

Gauged length, 4'.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
956	1,000	0.	0.	0.	0.	
4,790	5,000	.000100	.000100	0.	-----	
9,560	10,000	.000200	.000100	-----	-----	
14,340	15,000	.000375	.000175	-----	-----	
19,120	20,000	.000525	.000150	-----	-----	
23,900	25,000	.000700	.000175	-----	-----	
28,680	30,000	.000875	.000175	-----	-----	
33,460	35,000	.001000	.000125	-----	-----	
38,240	40,000	.001200	.000200	-.000025	-.000025	
43,020	45,000	.001325	.000125	0.	+.000025	
43,976	46,000	.001375	.000050	-----	-----	
44,932	47,000	.001425	.000050	-----	-----	
45,888	48,000	.001450	.000025	-----	-----	
46,844	49,000	.001475	.000025	-----	-----	
47,800	50,000	.001500	.000025	0.	-----	
48,756	51,000	.001525	.000025	-----	-----	
49,712	52,000	.001575	.000050	-----	-----	
50,668	53,000	.001625	.000050	-----	-----	
51,624	54,000	.005625	.004000	-----	-----	
52,580	55,000	.006175	.000550	-----	-----	
53,536	56,000	.006650	.000475	-----	-----	
55,448	58,000	.007950	.001300	-----	-----	
57,360	60,000	.009350	.001400	-----	-----	
59,272	62,000	.010600	.001250	-----	-----	
61,184	64,000	.012025	.001425	-----	-----	
63,096	66,000	.013450	.001425	-----	-----	
65,008	68,000	.014900	.001450	-----	-----	
66,920	70,000	.016450	.001550	-----	-----	
105,100	109,940	-----	-----	-----	-----	Ultimate strength.

Failed by triple flexure.

No. 4512.

Marks, <sup>10 R, J</sup><sub>M T, M</sub>  
 Diameter, ".564.  
 Sectional area, .25 square inch.  
 Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.              Elastic limit.      Tensile strength.
250	1,000	0.	0.	0.	0.	
1,250	5,000	.000067	.000067	0.	0.	
2,500	10,000	.000267	.000200	.....	.....	
5,000	20,000	.000600	.000333	.....	.....	
7,500	30,000	.000933	.000333	.....	.....	
8,750	35,000	.001067	.000134	.....	.....	
10,000	40,000	.001267	.000200	.....	.....	
10,500	42,000	.001333	.000066	0.	.....	
10,750	43,000	.001367	.000034	.....	.....	
11,000	44,000	.001400	.000033	.....	.....	
11,250	45,000	.001433	.000033	.....	.....	
11,500	46,000	.001467	.000034	.....	.....	
11,750	47,000	.001500	.000033	.....	.....	
12,000	48,000	.001533	.000033	.....	.....	
12,250	49,000	.001600	.000067	.....	.....	
12,500	50,000	.001633	.000033	.....	.....	
12,750	51,000	.001667	.000034	.....	.....	
13,000	52,000	.001700	.000033	.....	.....	
13,250	53,000	.001733	.000033	.....	.....	
13,500	54,000	.001800	.000067	.....	.....	
13,750	55,000	.001867	.000167	.....	.....	
14,000	56,000	.002533	.000566	.....	.....	
14,250	57,000	.003333	.000800	.....	.....	
14,500	58,000	.004000	.000667	.....	.....	
14,750	59,000	.004667	.000667	.....	.....	
25,620	102,480	.....	.....	.....	.....	

General summary.

Tensile strength per square inch of original section .....	pounds..	102,480
Elastic limit per square inch of original section .....	do..	54,000
Elongation per inch after rupture .....	inch..	.1900
Elongation per inch under strain at elastic limit .....	do..	.001800
Reduction in diameter at point of rupture .....	do..	.004
Reduction in area after rupture, per cent of original section .....	do..	30.6
Position of rupture .....	"	.75 from neck
Character of broken surface .....	granular	70 per cent, silky 30 per cent
Elongation of inch sections .....	"	.23*, ".18, ".11

JACKET NO. 4.

No. 4526.

Marks, <sup>10 R, J</sup><sub>B T, M</sub>

Diameter, ".564.

Sectional area, .25 square inch.

Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
250	1,000	0.	0.	0.	0.	
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000600	.000300	.....	.....	
7,500	30,000	.000933	.000333	.....	.....	
8,750	35,000	.001100	.000167	0.	.....	
10,000	40,000	.001267	.000167	.....	.....	
10,500	42,000	.001333	.000666	0.	.....	
10,750	43,000	.001367	.000034	.....	.....	
11,000	44,000	.001400	.000033	.....	.....	
11,250	45,000	.001433	.000033	.....	.....	
11,500	46,000	.001467	.000034	.....	.....	
11,750	47,000	.001533	.000066	.....	.....	
12,000	48,000	.001600	.000067	.....	.....	
12,250	49,000	.001633	.000033	.....	.....	
12,500	50,000	.008833	.007200	.....	.....	
12,750	51,000	.009200	.000367	.....	.....	
13,000	52,000	.010000	.000800	.....	.....	
13,250	53,000	.010933	.000933	.....	.....	
13,500	54,000	.012267	.001334	.....	.....	
22,000	88,120	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section.....	pounds..	88,120
Elastic limit per square inch of original section.....	do..	49,000
Elongation per inch after rupture.....	inch.	.220
Elongation per inch under strain at elastic limit.....	do..	.001633
Reduction in diameter at point of rupture.....	do..	.144
Reduction in area after rupture, per cent of original section.....		44.6
Position of rupture.....		1". 3 from neck
Character of broken surface.....		silky
Elongation of inch sections.....		" 12, " 27, " 27"

No. 976.

Marks, <sup>10 R, J</sup>  
<sub>B, T, M</sub>  
 Length, 5'.

Diameter, 1" .109.

Sectional area, .966 square inch.

Gauged length, 4'.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
966	1,000	0.	0.	0.	0.	
4,830	5,000	.000100	.000100	0.	.....	Elastic limit.
9,660	10,000	.000225	.000125	.....	.....	
14,490	15,000	.000375	.000150	.....	.....	
19,320	20,000	.000500	.000125	.....	.....	
24,150	25,000	.000675	.000175	.....	.....	
28,980	30,000	.000800	.000125	.....	.....	
33,810	35,000	.001000	.000200	.....	.....	
38,640	40,000	.001150	.000150	0.	.....	
43,470	45,000	.001400	.000250	0.	.....	
44,436	46,000	.001450	.000050	.....	.....	
45,402	47,000	.001500	.000050	.....	.....	
46,368	48,000	.001550	.000050	.....	.....	
47,334	49,000	.001650	.005000	.....	.....	
48,300	50,000	.001700	.000550	.....	.....	
50,232	52,000	.001875	.001275	.....	.....	
52,164	54,000	.001970	.001325	.....	.....	
54,096	56,000	.011275	.001575	.....	.....	
56,028	58,000	.012825	.001550	.....	.....	
57,960	60,000	.014350	.001525	.....	.....	
59,892	62,000	.016050	.001700	.....	.....	
61,824	64,000	.017625	.001575	.....	.....	
63,756	66,000	.019250	.001625	.....	.....	
65,688	68,000	.021500	.002250	.....	.....	
67,620	70,000	.023675	.002175	.....	.....	
94,200	97,520	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

No. 4525.

Marks, <sup>10</sup>R, J  
M T, M  
Diameter, <sup>11</sup>.564.  
Sectional area, .25 square inch.  
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
250	1,000	0.	0.	0.	0.	
1,250	5,000	.000100	.000100			
2,500	10,000	.000207	.000167			
5,000	20,000	.000423	.000346			
7,500	30,000	.000637	.000514			
8,750	35,000	.001133	.000166	.000033	.000033	
10,000	40,000	.001800	.000167			
10,500	42,000	.001387	.000067	.000033	0.	
10,750	43,000	.001400	.000033			
11,000	44,000	.001433	.000033			
11,250	45,000	.001467	.000034			
11,500	46,000	.001533	.000066			
11,750	47,000	.001567	.000034			
12,000	48,000	.001600	.000033			
12,250	49,000	.001667	.000067			
12,500	50,000	.001700	.000033			
12,750	51,000	.001767	.000067			
13,000	52,000	.002467	.000700			
13,250	53,000	.003000	.000533			
13,500	54,000	.004000	.001000			
13,750	55,000	.004633	.000633			
14,000	56,000	.006000	.001367			
24,260	97,040					Tensile strength.

General summary.

Tensile strength per square inch of original section.....pounds.. 97,040  
Elastic limit per square inch of original section.....do... 51,000  
Elongation per inch after rupture.....inch... .1900  
Elongation per inch under strain at elastic limit.....do... .001767  
Reduction in area after rupture.....do... .124  
Reduction in area after rupture, per cent of original section..... 39.2  
Position of rupture....."1.21 from neck  
Character of broken surface.....silky  
Elongation of inch sections.....".12", ".24", ".21"

No. 976.

Marks, 10 R, J  
B T, M

Length, 5'.

Diameter, 1".109.

Sectional area, .966 square inch.

Gauged length, 4'.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
968	1,000	0.	0.	0.	0.	
4,830	5,000	.000100	.000100	0.	0.	
8,660	10,000	.000225	.000125	0.	0.	
14,490	15,000	.000375	.000150	0.	0.	
19,320	20,000	.000500	.000125	0.	0.	
24,150	25,000	.000675	.000175	0.	0.	
28,980	30,000	.000800	.000125	0.	0.	
33,810	35,000	.001000	.000200	0.	0.	
38,640	40,000	.001150	.000150	0.	0.	
43,470	45,000	.001400	.000250	0.	0.	
44,438	46,000	.001450	.000050	0.	0.	
45,402	47,000	.001500	.000050	0.	0.	
46,368	48,000	.001550	.000050	0.	0.	
47,334	49,000	.000550	.000500	0.	0.	
48,300	50,000	.007100	.000550	0.	0.	
50,232	52,000	.008375	.001275	0.	0.	
52,164	54,000	.009700	.001325	0.	0.	
54,096	56,000	.011275	.001575	0.	0.	
56,028	58,000	.012825	.001550	0.	0.	
57,960	60,000	.014350	.001525	0.	0.	
59,892	62,000	.016050	.001700	0.	0.	
61,824	64,000	.017625	.001575	0.	0.	
63,756	66,000	.019250	.001625	0.	0.	
65,688	68,000	.021500	.002250	0.	0.	
67,620	70,000	.023675	.002175	0.	0.	
94,200	97,520	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

No. 4525.

Marks, <sup>10 R, J</sup>  
<sup>M T, M</sup>  
 Diameter, <sup>1</sup>/<sub>16</sub>.564.  
 Sectional area, .25 square inch.  
 Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
250	1,000	0.	0.	0.	0.	
1,250	5,000	.000100	.000100			
2,500	10,000	.000287	.000167			
5,000	20,000	.000633	.000366			
7,500	30,000	.000867	.000334			
8,750	35,000	.001133	.000166	.000033	.000033	
10,000	40,000	.001300	.000167			
10,500	42,000	.001387	.000067	.000033	0.	
10,750	43,000	.001400	.000033			
11,000	44,000	.001433	.000033			
11,250	45,000	.001487	.000034			
11,500	46,000	.001533	.000066			
11,750	47,000	.001587	.000034			
12,000	48,000	.001600	.000033			
12,250	49,000	.001687	.000067			
12,500	50,000	.001700	.000033			
12,750	51,000	.001787	.000067			
13,000	52,000	.002487	.000700			
13,250	53,000	.003000	.000533			
13,500	54,000	.004000	.001000			
13,750	55,000	.004633	.000633			
14,000	56,000	.006000	.001367			
24,260	97,040					Tensile strength.

General summary.

Tensile strength per square inch of original section.....pounds.. 97,040  
 Elastic limit per square inch of original section.....do... 51,000  
 Elongation per inch after rupture.....inch... .1900  
 Elongation per inch under strain at elastic limit.....do... .001767  
 Reduction in diameter at point of rupture.....do... .124  
 Reduction in area after rupture, per cent of original section.....do... 39.2  
 Position of rupture....."1.21 from neck  
 Character of broken surface....."12, "24\*, "21\* silky  
 Elongation of inch sections....."12, "24\*, "21\*

## JACKET No. 5.

No. 998.

Marks, <sup>10 F, J</sup>  
<sub>B T, M</sub>

Length, 5''.

Diameter' 1'' .127.

Sectional area, 1 square inch.

Gauged length, 4''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
1,000	1,000	0.	0.	0.	0.	Initial load.
5,000	5,000	.000100	.000100			
10,000	10,000	.000225	.000125			
15,000	15,000	.000350	.000125			
20,000	20,000	.000500	.000150			
25,000	25,000	.000625	.000125			
30,000	30,000	.000775	.000150			
35,000	35,000	.000950	.000175			
40,000	40,000	.001150	.000200	.000075	.000075	Elastic limit.
41,000	41,000	.001250	.000100			
42,000	42,000	.001325	.000075			
43,000	43,000	.001375	.000050			
44,000	44,000	.001950	.000575			
45,000	45,000	.003575	.001625	.002175	.002100	
46,000	46,000	.004200	.000625			
48,000	48,000	.006050	.001850			
50,000	50,000	.007375	.001325			
52,000	52,000	.008875	.001500			
54,000	54,000	.010300	.001425			
56,000	56,000	.012025	.001725			
58,000	58,000	.013375	.001350			
60,000	60,000	.015150	.001775			
62,000	62,000	.016450	.001300			
64,000	64,000	.018350	.001900			
66,000	66,000	.019675	.001525			
68,000	68,000	.021850	.001975			
70,000	70,000	.024000	.002150			
101,460	101,460					Ultimate strength.

Failed by triple flexure.



JACKET No. 6.

No. 4593.

Marks, <sup>10 B, J</sup><sub>B T, M</sub>

Diameter, <sup>11</sup>/<sub>M</sub> 564.

Sectional area, .25 square inch.

Gauged length, 3''.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000087	.000087	0.	.....	
2,500	10,000	.000287	.000200	.....	.....	
5,000	20,000	.000800	.000333	.....	.....	
7,500	30,000	.000987	.000387	.....	.....	
8,750	35,000	.001133	.000186	0.	.....	
10,000	40,000	.001333	.000200	.....	.....	
10,500	42,000	.001400	.000087	0.	.....	
10,750	43,000	.001433	.000033	.....	.....	
11,000	44,000	.001467	.000034	.....	.....	
11,250	45,000	.001500	.000033	.....	.....	Elastic limit.
11,500	46,000	.001587	.000087	.....	.....	
11,750	47,000	.001633	.000066	.....	.....	
12,000	48,000	.002067	.001034	.....	.....	
12,250	49,000	.005733	.003066	.....	.....	
12,500	50,000	.006500	.000787	.....	.....	
13,750	51,000	.007087	.000587	.....	.....	
13,000	52,000	.008187	.001100	.....	.....	
22,980	91,920	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section.....	pounds..	91,920
Elastic limit per square inch of original section.....	do ..	47,000
Elongation per inch after rupture.....	inch ..	.230
Elongation per inch under strain at elastic limit.....	do ..	.001638
Reduction in diameter at point of rupture.....	do ..	.184
Reduction in area after rupture, per cent of original section.....	.....	41.9
Position of rupture.....	.....	1'' .85 from neck
Character of broken surface.....	.....	silky, serrated
Elongation of inch sections.....	.....	" .19, ".87, ".14

H. Ex. 43—6

No. 4592.

Marks, <sup>10 R, J</sup><sub>M T, M</sub>  
 Diameter, <sup>11</sup>.564.  
 Sectional area, .25 square inch.  
 Gauged length, 3''.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
250	1,000	0.	0.	0.	0.	
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000267	.000200	.....	.....	
5,000	20,000	.000567	.000300	.....	.....	
7,500	30,000	.000900	.000333	.....	.....	
8,750	35,000	.001067	.000167	0.	.....	
10,000	40,000	.001300	.000233	.....	.....	
10,500	42,000	.001367	.000067	0.	.....	
10,750	43,000	.001400	.000033	.....	.....	
11,000	44,000	.001433	.000033	.....	.....	
11,250	45,000	.001467	.000034	.....	.....	
11,500	46,000	.001533	.000066	.....	.....	
11,750	47,000	.001600	.000067	.....	.....	
12,000	48,000	.001667	.000267	.....	.....	
12,250	49,000	.002600	.000733	.....	.....	
12,500	50,000	.004733	.002133	.....	.....	
12,750	51,000	.005400	.000667	.....	.....	
13,000	52,000	.006667	.001267	.....	.....	
23,020	92,080	.....	.....	.....	.....	Tensile strength.

*General summary.*

Tensile strength per square inch of original section.....	pounds..	92,080
Elastic limit per square inch of original section.....	do..	47,000
Elongation per inch after rupture.....	inch..	.200
Elongation per inch under strain at elastic limit.....	do..	.001600
Reduction in diameter at point of rupture.....	do..	.154
Reduction in area after rupture, per cent of original section.....	.....	47.2
Position of rupture.....	.....	1'' .10 from neck
Character of broken surface.....	.....	silky
Elongation of inch sections.....	.....	"12, "20, "23"

JACKET NO. 9.

No. 4602.

Marks, <sup>10 R, J</sup>  
<sub>B T, M</sub>

Diameter, ".564.

Sectional area, 25 square inch.

Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000300	.000167	.....	.....	
5,000	20,000	.000667	.000367	.....	.....	
7,500	30,000	.001033	.000366	.....	.....	
8,750	35,000	.001233	.000200	.000067	.000067	
10,000	40,000	.001367	.000134	.....	.....	
10,500	42,000	.001467	.000100	.000067	0.	
10,750	43,000	.001533	.000066	.....	.....	
11,000	44,000	.001600	.000067	.....	.....	
11,250	45,000	.001633	.000033	.....	.....	Elastic limit.
11,500	46,000	.001667	.000234	.....	.....	
11,750	47,000	.001667	.001300	.....	.....	
12,000	48,000	.004667	.001500	.....	.....	
12,250	49,000	.005500	.000833	.....	.....	
12,500	50,000	.006667	.001167	.....	.....	Tensile strength.
22,690	90,760	.....	.....	.....	.....	

General summary.

Tensile strength, per square inch of original section .....	pounds..	90,760
Elastic limit, per square inch of original section .....	do...	45,000
Elongation per inch after rupture .....	inch..	.220
Elongation per inch under strain at elastic limit .....	do...	.001633
Reduction in diameter at point of rupture .....	do...	.124
Reduction in area after rupture, per cent of original section .....	do...	39.2
Position of rupture .....	.....	1" from neck
Character of broken surface .....	.....	silky 50 per cent, granular 50 per cent
Elongation of inch sections .....	.....	" 16, " 19, " 31"

No. 4603.

Marks, <sup>10 R, J</sup>  
<sub>M T, M</sub>  
 Diameter, ".564.  
 Sectional area, .25 square inch.  
 Gauged length, 3".

Applied loads. *		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
250	1,000	0.	0.	0.	0.	
1,250	5,000	.000100	.000100	0.	0.	
2,500	10,000	.000267	.000167	0.	0.	
5,000	20,000	.000600	.000333	0.	0.	
7,500	30,000	.000933	.000333	0.	0.	
8,750	35,000	.001100	.000167	0.	0.	
10,000	40,000	.001267	.000167	0.	0.	
10,500	42,000	.001333	.000066	0.	0.	
10,750	43,000	.001367	.000034	0.	0.	
11,000	44,000	.001400	.000033	0.	0.	
11,250	45,000	.001467	.000067	0.	0.	
11,500	46,000	.001523	.000066	0.	0.	
11,750	47,000	.001700	.000167	0.	0.	
12,000	48,000	.002067	.000367	0.	0.	
12,250	49,000	.002500	.000433	0.	0.	
12,500	50,000	.003100	.000600	0.	0.	
12,750	51,000	.003667	.000867	0.	0.	
23,790	95,160	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section.....	pounds..	95,160
Elastic limit per square inch of original section.....	do.....	46,000
Elongation per inch after rupture.....	inch.....	.2033
Elongation per inch under strain at elastic limit.....	do.....	.001523
Reduction in diameter at point of rupture.....	do.....	.124
Reduction in area after rupture, per cent of original section.....	.....	39.2
Position of rupture.....	.....	1".5 from neck
Character of broken surface.....	.....	silky, serrated
Elongation of inch sections.....	.....	".15, ".33, ".13

JACKET No. 12.

No. 4615.

Marks, <sup>10 R, J</sup><sub>B T, M</sub>

Diameter, ".564.

Sectional area, .25 square inch.

Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
250	1,000	0.	0.	0.	0.	
1,250	5,000	.000188	.000188	0.	.....	
2,500	10,000	.000333	.000200	.....	.....	
5,000	20,000	.000700	.000667	.....	.....	
7,500	30,000	.001033	.000833	.....	.....	
8,750	35,000	.001288	.000900	0.	.....	
10,000	40,000	.001807	.000934	.....	.....	
10,500	42,000	.001433	.000666	.000033	.000033	
10,750	43,000	.001467	.000684	.....	.....	
11,000	44,000	.001533	.000666	.....	.....	
11,250	45,000	.001567	.000684	.....	.....	
11,500	46,000	.001633	.000666	.....	.....	
11,750	47,000	.001667	.000684	.....	.....	
12,000	48,000	.001700	.000633	.....	.....	
12,250	49,000	.001733	.000633	.....	.....	
12,500	50,000	.001767	.000634	.....	.....	
12,750	51,000	.001833	.000666	.....	.....	
13,000	52,000	.002500	.000667	.....	.....	
13,250	53,000	.005433	.002823	.....	.....	
13,500	54,000	.006167	.000734	.....	.....	
13,750	55,000	.006833	.000666	.....	.....	
14,000	56,000	.008167	.001234	.....	.....	
23,980	95,920	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section.....	pounds..	95,926
Elastic limit per square inch of original section.....	do..	51,000
Elongation per inch after rupture.....	inch..	.2033
Elongation per inch under strain at elastic limit.....	do..	.001833
Reduction in diameter at point of rupture.....	do..	.124
Reduction in area after rupture, per cent of original section.....		59.2
Position of rupture.....	at middle of stem	
Character of broken surface.....	silky	
Elongation of inch sections.....	"14, "32, "15	



JACKET No. 13.

No. 4674.

Marks, <sup>10 R, 11 J</sup><sub>B T, M</sub>

Diameter, ".564.

Sectional area, .25 square inch.

Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
250	1,000	0.	0.	0.	0.	
1,250	5,000	.000067	.000067	0.	0.	
2,500	10,000	.000300	.000233	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.001000	.000367	.....	.....	
8,750	35,000	.001200	.000200	0.	.....	
10,000	40,000	.001367	.000167	.....	.....	
10,500	42,000	.001400	.000033	0.	.....	
10,750	43,000	.001433	.000033	.....	.....	
11,000	44,000	.001500	.000067	.....	.....	
11,250	45,000	.001567	.000067	.....	.....	
11,500	46,000	.001633	.000066	.....	.....	
11,750	47,000	.001667	.000034	.....	.....	
12,000	48,000	.001733	.000066	.....	.....	
12,250	49,000	.005033	.001300	.....	.....	
12,500	50,000	.005167	.002134	.....	.....	
12,750	51,000	.006333	.001166	.....	.....	
13,000	52,000	.007333	.001000	.....	.....	
13,250	53,000	.008000	.000667	.....	.....	
22,540	90,160	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section.....	pounds..	90,160
Elastic limit per square inch of original section.....	do..	48,000
Elongation per inch after rupture.....	inch..	.2093
Elongation per inch under strain at elastic limit.....	do..	.001783
Reduction in diameter at point of rupture.....	do..	.154
Reduction in area after rupture, per cent of original section.....		47.2
Position of rupture.....	1", 3 from neck	
Character of broken surface.....	sliky	
Elongation of inch sections.....	" .18, ".32, ".11	

No. 4614.

Marks, <sup>10 B, 11 J</sup><sub>M T, M</sub>

Diameter, ".564.

Sectional area, .25 square inch.

Gauged, length 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
250	1,000	0.	0.	0.	0.	
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000300	.000167	.....	.....	
5,000	20,000	.000033	.000333	.....	.....	
7,500	30,000	.000033	.000300	.....	.....	
8,750	35,000	.001067	.000134	0.	.....	
10,000	40,000	.001267	.000200	.....	.....	
10,500	42,000	.001367	.000100	0.	.....	
10,750	43,000	.001400	.000033	.....	.....	
11,000	44,000	.001433	.000033	.....	.....	
11,250	45,000	.001467	.000034	.....	.....	
11,500	46,000	.001500	.000033	.....	.....	
11,750	47,000	.001567	.000067	.....	.....	
12,000	48,000	.001600	.000033	.....	.....	
12,250	49,000	.001633	.000033	.....	.....	
12,500	50,000	.001667	.000034	.....	.....	
12,750	51,000	.001733	.000066	.....	.....	
13,000	52,000	.002467	.000734	.....	.....	
13,250	53,000	.003833	.001366	.....	.....	
13,500	54,000	.004933	.001100	.....	.....	
13,750	55,000	.005933	.001000	.....	.....	
14,000	56,000	.006833	.000900	.....	.....	
23,740	94,960	.....	.....	.....	.....	Tensile strength.

*General summary.*

Tensile strength per square inch of original section.....	pounds..	94,960
Elastic limit per square inch of original section.....	do.	51,000
Elongation per inch after rupture.....	inch..	.2038
Elongation per inch under strain at elastic limit.....	do.	.001783
Reduction in diameter at point of rupture.....	do.	.144
Reduction in area after rupture, per cent of original section.....		44.6
Position of rupture.....	1. "21 from neck	
Character of broken surface.....	.....	silky
Elongation of inch sections.....	" 15, " 25, " 21"	



## JACKET NO. 13.

No. 4674.

Marks, <sup>10 R, J</sup><sub>B T, M</sub>

Diameter, ".564.

Sectional area, .25 square inch.

Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
250	1,000	0.	0.	0.	0.	
1,250	5,000	.000067	.000067	0.	0.	
2,500	10,000	.000300	.000233	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.001000	.000367	.....	.....	
8,750	35,000	.001200	.000200	0.	.....	
10,000	40,000	.001367	.000187	.....	.....	
10,500	42,000	.001400	.000033	0.	.....	
10,750	43,000	.001433	.000033	.....	.....	
11,000	44,000	.001500	.000067	.....	.....	
11,250	45,000	.001567	.000067	.....	.....	
11,500	46,000	.001633	.000066	.....	.....	
11,750	47,000	.001667	.000034	.....	.....	
12,000	48,000	.001733	.000066	.....	.....	
12,250	49,000	.008033	.001300	.....	.....	
12,500	50,000	.005167	.002134	.....	.....	
12,750	51,000	.006333	.001166	.....	.....	
13,000	52,000	.007333	.001000	.....	.....	
12,250	53,000	.008000	.000667	.....	.....	
22,540	90,160	.....	.....	.....	.....	Tensile strength.

*General summary.*

Tensile strength per square inch of original section..... pounds.. 90,160  
 Elastic limit per square inch of original section..... do.. 48,000  
 Elongation per inch after rupture..... inch.. .2038  
 Elongation per inch under strain at elastic limit..... do.. .001733  
 Reduction in diameter at point of rupture..... do.. .154  
 Reduction in area after rupture, per cent of original section..... do.. 47.3  
 Position of rupture..... 1", 3 from neck  
 Character of broken surface..... silky  
 Elongation of inch sections..... ". 18, ". 32, ". 11

Marks, <sup>10</sup> B, <sup>J</sup>  
 M T, M  
 Diameter, <sup>1</sup>/<sub>16</sub> .563.  
 Sectional area, .25 square inch.  
 Gauged length, 3''.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
250	1,000	0.	0.	0.	0.	
1,250	5,000	.000067	.000067	0.	0.	
2,500	10,000	.000333	.000266	0.	0.	
5,000	20,000	.000667	.000334	0.	0.	
7,500	30,000	.001000	.000333	0.	0.	
8,750	35,000	.001223	.000233	0.	0.	
10,000	40,000	.001367	.000134	0.	0.	
10,500	42,000	.001400	.000033	0.	0.	
10,750	43,000	.001467	.000067	0.	0.	
11,000	44,000	.001500	.000033	0.	0.	
11,250	45,000	.001567	.000067	0.	0.	
11,500	46,000	.001600	.000033	0.	0.	
11,750	47,000	.001633	.000033	0.	0.	
12,000	48,000	.002167	.000534	0.	0.	Elastic limit.
12,250	49,000	.003667	.001500	0.	0.	
12,500	50,000	.005333	.001666	0.	0.	
12,750	51,000	.006000	.000667	0.	0.	
13,000	52,000	.006667	.000667	0.	0.	Tensile strength.
22,620	90,480	.....	.....	.....	.....	

General summary.

Tensile strength per square inch of original section .....	pounds ..	90,480
Elastic limit per square inch of original section .....	do ..	47,000
Elongation per inch after rupture .....	inch ..	.3233
Elongation per inch under strain at elastic limit .....	do ..	.001633
Reduction in diameter at point of rupture .....	do ..	.124
Reduction in area after rupture, per cent of original section .....	do ..	39.2
Position of rupture .....	.....	1'' .56 from neck.
Character of broken surface .....	.....	silky, trace of granulation.
Elongation of inch sections .....	.....	" .17, " .30, " .14

10-INCH STEEL B. L. RIFLES.

**SPECIFIC GRAVITY AND HARDNESS OF TUBES, JACKETS, AND HOOPS.**

No tension tests of these specimens.

Number of rifle.	Position in rifle.	Marks on specimen.	Specific gravity.	Hardness.
4	Tube.....	10 R <sub>4</sub> T-B R <sub>4</sub> M.....	7.8550	20.70
5	do.....	10 R <sub>4</sub> T-B R <sub>4</sub> M.....	7.8539	16.47
6	do.....	10 R <sub>4</sub> T-B R <sub>4</sub> M.....	7.8594	20.36
7	do.....	10 R <sub>4</sub> T-B R <sub>4</sub> M.....	7.8635	18.48
8	do.....	10 R <sub>4</sub> T-B R <sub>4</sub> M.....	7.8632	20.47
3	Jacket.....	10 R <sub>3</sub> J-B R <sub>10</sub> M.....	7.8542	21.52
4	do.....	10 R <sub>3</sub> J-B R <sub>4</sub> M.....	7.8543	16.47
5	do.....	10 R <sub>3</sub> J-B R <sub>4</sub> M.....	7.8634	18.38
6	Hoop A <sub>4</sub> .....	10 R <sub>4</sub> A <sub>4</sub> -R <sub>4</sub> M.....	7.8627	22.64

**TABULATION OF TENSION SPECIMENS FROM 10-INCH STEEL B. L. RIFLES.**

[Stems 3 inches long, .564 inch diameter.]

No. of test.	Position in gun.	Location of specimens.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation.	Contraction of area.	Appearance of fracture.
			<i>Pounds.</i>	<i>Pounds.</i>	<i>P. cent.</i>	<i>P. cent.</i>	
4534	Tube No. 4....	Middle..	48,000	95,000	19.7	33.5	Granular, 75 per cent; silky, 25 per cent.*
4533	do.....	do.....	48,000	92,840	18.7	41.9	Silky.†
4583	Tube No. 7....	do.....	47,000	92,140	22.7	45.0	Do.*
4582	do.....	do.....	44,000	89,360	22.3	47.4	Do.†
4609	Tube No. 10....	do.....	48,000	91,920	21.7	41.9	Silky, serrated.*
4608	do.....	do.....	50,000	89,960	21.0	39.2	Granular, 60 per cent; silky, 40 per cent.†
4617	Tube No. 15....	do.....	48,000	96,560	18.7	36.4	Silky, serrated.*
4616	do.....	do.....	46,000	92,440	13.3	15.0	Granular, flaky spot at circumference.†
4680	Tube No. 16....	do.....	45,000	85,240	24.3	52.2	Silky.*
4679	do.....	do.....	49,000	90,840	21.0	44.6	Do.†
4613	Jacket No. 3....	do.....	54,000	105,240	16.0	21.4	Granular.*
4512	do.....	do.....	54,000	102,480	19.0	30.6	Granular, 70 per cent; silky, 30 per cent.†
4526	Jacket No. 4....	do.....	49,000	88,120	22.0	44.6	Silky.*
4525	do.....	do.....	51,000	97,040	19.0	39.2	Do.†
4593	Jacket No. 6....	do.....	47,000	91,920	23.0	41.9	Silky, serrated.*
4592	do.....	do.....	47,000	92,080	20.0	47.2	Silky.†
4602	Jacket No. 9....	do.....	45,000	90,760	22.0	39.2	Silky, 50 per cent; granular, 50 per cent.†
4608	do.....	do.....	46,000	95,160	20.3	39.2	Silky, serrated.†
4615	Jacket No. 12....	do.....	51,000	95,920	20.3	39.2	Silky.*
4614	do.....	do.....	51,000	94,960	20.3	44.6	Do.†
4674	Jacket No. 13....	do.....	48,000	90,160	20.3	47.2	Do.*
4673	do.....	do.....	47,000	90,480	22.3	39.2	Silky, trace of granulation.†

\* Breech end.

† Muzzle end.

**TABULATION OF COMPRESSION SPECIMENS FROM 10-INCH STEEL B. L. RIFLES.**

No. of test.	Position in gun.	Location of specimens.	Elastic limit per square inch.	Ultimate strength per square inch.	Manner of failure.
			<i>Pounds.</i>	<i>Pounds.</i>	
990	Tube No. 4....	Middle.....	50,000	102,200	Double flexure.*
991	Tube No. 5....	do.....	43,000	95,230	Do.*
974	Tube No. 6....	do.....	50,000	108,400	Triple flexure.*
999	Tube No. 7....	do.....	48,000	102,860	Do.*
1,000	Tube No. 8....	do.....	49,000	106,400	Do.*
975	Jacket No. 3....	do.....	53,000	109,940	Do.*
976	Jacket No. 4....	do.....	48,000	97,520	Do.*
998	Jacket No. 5....	do.....	40,000	101,460	Do.*

\* Breech end.



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**10-INCH WIRE-WRAPPED B. L. RIFLE (CROZIER).**

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**SPECIMENS FROM JACKET.**

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No. 4704.

Marks, <sup>10 W R J</sup><sub>B T O</sub>  
 Diameter, .565.  
 Sectional area, .25 square inch.  
 Gaged length, 3''.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
250	1,000	0.	0.	0.	0.	
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000333	.000233	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001000	.000333	0.	.....	
8,000	31,000	.001033	.000333	.....	.....	
8,000	32,000	.001067	.000334	.....	.....	
8,250	33,000	.001133	.000366	.....	.....	
8,500	34,000	.001200	.000367	.....	.....	
8,750	35,000	.001267	.000367	0.	.....	
9,000	36,000	.001500	.000233	.....	.....	
9,250	37,000	.001567	.000467	.....	.....	
9,500	38,000	.002333	.000966	.....	.....	
9,750	39,000	.004067	.001134	.....	.....	
10,000	40,000	.005333	.001266	.....	.....	
18,300	73,500	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section .....	pounds..	73,500
Elastic limit per square inch of original section .....	do...	35,000
Elongation per inch after rupture .....	inch...	.2087
Elongation per inch under strain at elastic limit .....	do...	.001267
Reduction in diameter at point of rupture .....	do...	.125
Reduction in area after rupture, per cent of original section .....	.....	39.2
Position of rupture .....	.....	.1'' from neck
Character of broken surface .....	.....	silky
Elongation of inch sections .....	.....	".11, ".18, ".33-

No. 4705.

Marks, <sup>10 W R, J</sup>  
<sub>B T, M</sub>

Diameter, <sup>1</sup>/<sub>16</sub> .564.

Sectional area, .25 square inch.

Gauged length, 3'.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	0.	
2,500	10,000	.000333	.000233	0.	0.	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001100	.000433	.000033	.000033	Elastic limit.
7,750	31,000	.001200	.000100	.....	.....	
8,000	32,000	.002000	.000800	.....	.....	
8,250	33,000	.003400	.001400	.....	.....	
8,500	34,000	.004600	.001200	.....	.....	Tensile strength.
8,750	35,000	.005333	.000733	.....	.....	
17,240	68,960	.....	.....	.....	.....	

General summary.

Tensile strength per square inch of original section .....	pounds..	68,960
Elastic limit per square inch of original section .....	do..	30,000
Elongation per inch after rupture .....	inch..	.2633
Elongation per inch under strain at elastic limit .....	do..	.001100
Reduction in diameter at point of rupture .....	do..	.164
Reduction in area after rupture, per cent of original section .....	do..	49.7
Position of rupture .....	1" I from neck	
Character of broken surface .....	silky	
Elongation of inch sections .....	"40", "21", "18	



No. 4706.

Marks, <sup>10 WR, J</sup>BT, <sup>1/2</sup>M  
 Diameter, <sup>1/2</sup>.564.  
 Sectional area, .25 square inch.  
 Gauged length, 3'.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
250	1,000	0.	0.	0.	0.	
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000333	.000233	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001033	.000366	0.	.....	
8,750	31,000	.001067	.000334	.....	.....	
8,000	32,000	.001133	.000066	.....	.....	
8,250	33,000	.001200	.000067	.....	.....	
8,500	34,000	.001267	.000067	.....	.....	
8,750	35,000	.001333	.000066	.000033	.000033	
9,000	36,000	.001400	.000067	.....	.....	
9,250	37,000	.001467	.000533	.....	.....	
9,500	38,000	.001533	.001734	.....	.....	
9,750	39,000	.001600	.001000	.....	.....	
10,000	40,000	.001667	.001333	.....	.....	
10,250	41,000	.001733	.001133	.....	.....	
18,210	72,840	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section .....	pounds..	72,840
Elastic limit per square inch of original section .....	do..	36,000
Elongation per inch after rupture .....	inch..	.2567
Elongation per inch under strain at elastic limit .....	do..	.001400
Reduction in diameter at point of rupture .....	do..	.154
Reduction in area after rupture, per cent of original section .....		47.2
Position of rupture .....	1" 4 from neck	
Character of broken surface .....	silky	
Elongation of inch sections .....	" 16, " 38, " 23	

No. 4707.

Marks, <sup>10 W R, J</sup>  
<sup>B T, M</sup>  
 Diameter ".564.  
 Sectional area, .25 square inch.  
 Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000333	.000233	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001000	.000333	0.	.....	
7,750	31,000	.001067	.000067	.....	.....	
8,000	32,000	.001133	.000066	.....	.....	
8,250	33,000	.001233	.000100	.....	.....	
8,500	34,000	.001300	.000067	.....	.....	
8,750	35,000	.003667	.002367	.....	.....	
9,000	36,000	.004500	.000833	.....	.....	
9,250	37,000	.005067	.000567	.....	.....	
9,500	38,000	.006333	.001266	.....	.....	
9,750	39,000	.007700	.001387	.....	.....	
17,750	71,000	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section.....	pounds..	71,000
Elastic limit per square inch of original section.....	do..	34,000
Elongation per inch after rupture.....	inch..	.2567
Elongation per inch under strain at elastic limit.....	do..	.001300
Reduction in diameter at point of rupture.....	do..	.164
Reduction in area after rupture, per cent of original section.....		49.7
Position of rupture.....	1".	7 from neck
Character of broken surface.....		silky
Elongation of inch sections.....	".	14, " 44, " 19

No. 4700.

Marks, <sup>10 W R, J</sup><sub>M T, O</sub>

Diameter, <sup>11</sup>.564.

Sectional area, .25 square inch.

Gauged length, 3''.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000333	.000233	.....	.....	
5,000	20,000	.000687	.000334	.....	.....	
7,250	29,000	.001000	.000333	.....	.....	Elastic limit.
7,500	30,000	.001333	.000333	.000267	.000267	
7,750	31,000	.001800	.000467	.....	.....	
8,000	32,000	.002300	.000500	.....	.....	
8,250	33,000	.002687	.000367	.....	.....	
8,500	34,000	.003433	.000766	.....	.....	
17,540	70,160	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section.....	pounds..	70,160
Elastic limit per square inch of original section.....	do. . . . .	29,000
Elongation per inch after rupture.....	inch. . . . .	.270
Elongation per inch under strain at elastic limit.....	do. . . . .	.001000
Reduction in diameter at point of rupture.....	do. . . . .	.174
Reduction in area after rupture, per cent of original section.....		52.3
Position of rupture.....	1''.08 from neck	
Character of broken surface.....	slipky	
Elongation of inch sections.....	" 18, " 22, " 41"	

H. Ex. 43—7

No. 4701.

Marks, <sup>10 W R J</sup><sub>M T, K</sub>  
 Diameter, ".564.  
 Sectional area, .25 square inch.  
 Gauged length, 3'.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.  Elastic limit.            Tensile strength.
250	1,000	0.	0.	0.	0.	
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000333	.000233	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,000	28,000	.000933	.000266	.....	.....	
7,250	29,000	.001100	.000167	.....	.....	
7,500	30,000	.001467	.000367	.000367	.000367	
7,750	31,000	.001833	.000366	.....	.....	
8,000	32,000	.002467	.000634	.....	.....	
8,250	33,000	.003000	.000533	.....	.....	
8,500	34,000	.003667	.000867	.....	.....	
8,750	35,000	.004667	.000800	.....	.....	
17,510	70,040	.....	.....	.....	.....	

General summary.

Tensile strength per square inch of original section.....	pounds..	70,040
Elastic limit per square inch of original section.....	do ..	28,000
Elongation per inch after rupture.....	inch ..	.280
Elongation per inch under strain at elastic limit.....	do ..	.000333
Reduction in diameter at point of rupture.....	do ..	.184
Reduction in area after rupture, per cent of original section.....		49.7
Position of rupture.....	1".7 from neck	
Character of broken surface.....	silky	
Elongation of inch sections.....	"14, "42", "23	

No. 4702.

Marks, <sup>10 W R, J</sup>  
 M T, M  
 Diameter, ".564.  
 Sectional area, .25 square inch.  
 Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
250	1,000	0.	0.	0.	0.	
1,250	5,000	.000100	.000160	0.	.....	Elastic limit.
2,500	10,000	.000333	.000233	.....	.....	
5,000	20,000	.000700	.000367	.....	.....	
6,750	27,000	.000933	.000233	.....	.....	
7,000	28,000	.001100	.000167	.....	.....	
7,250	29,000	.001300	.000200	.....	.....	
7,500	30,000	.001700	.000400	.000600	.000600	
7,750	31,000	.002500	.000800	.....	.....	
8,000	32,000	.003033	.000533	.....	.....	
8,250	33,000	.003667	.000634	.....	.....	
8,500	34,000	.004333	.000666	.....	.....	
8,750	35,000	.005600	.001267	.....	.....	
17,140	68,560	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength, per square inch of original section ..... pounds.. 68,560  
 Elastic limit per square inch of original section ..... do... 27,000  
 Elongation per inch after rupture ..... inch... .2567  
 Elongation per inch under strain at elastic limit ..... do... .000933  
 Reduction in diameter at point of rupture ..... do... .164  
 Reduction in area after rupture, per cent of original section ..... do... 49.7  
 Position of rupture ..... 1".7 from neck  
 Character of broken surface ..... silky  
 Elongation of inch sections ..... ".18, ".42, ".17

No. 4703.

Marks, <sup>10 W R, J</sup>  
<sub>M T, I</sub>  
 Diameter, ".564.  
 Sectional area, .25 square inch.  
 Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
250	1,000	0.	0.	0.	0.	
1,250	5,000	.000067	.000067	0.	0.	
2,500	10,000	.000200	.000233	.....	.....	
5,000	20,000	.000667	.000367	.....	.....	
6,250	25,000	.000867	.000200	.....	.....	
6,500	26,000	.000933	.000066	0.	.....	
6,750	27,000	.000967	.000134	.....	.....	
7,000	28,000	.001000	.000033	.....	.....	
7,250	29,000	.001033	.000033	.....	.....	
7,500	30,000	.001133	.000100	.....	.....	
7,750	31,000	.001367	.000234	.....	.....	
8,000	32,000	.001700	.000333	.....	.....	
8,250	33,000	.002067	.000367	.....	.....	
8,500	34,000	.003000	.000933	.....	.....	
8,750	35,000	.003967	.000967	.....	.....	
17,890	71,560	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section .....	pounds..	71,560
Elastic limit per square inch of original section .....	do.....	29,000
Elongation per inch after rupture .....	inch..	.2367
Elongation per inch under strain at elastic limit.....	do.....	.001033
Reduction in diameter at point of rupture.....	do.....	.174
Reduction in area after rupture, per cent of original section.....	do.....	52.2
Position of rupture.....	.....	1" from neck
Character of broken surface.....	.....	silky
Elongation of inch sections.....	.....	".12, ".18, ".41*

TABULATION OF TENSION SPECIMENS FROM 10-INCH WIRE-WRAPPED B. L. RIFLE (CROZIER).

[Stems 3 inches long, ".564 diameter.]

No. of test.	Position in gun.	Location of specimens.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation.	Contraction of area.	Appearance of fracture.
4704	Jacket No. 1...	Outside.	<i>Pounds.</i> 85,000	<i>Pounds.</i> 73,560	<i>Per cent.</i> 20.7	<i>Per cent.</i> 39.2	Silky.*
4705	...do.....	Middle..	30,000	68,960	26.3	49.7	Do.*
4706	...do.....	...do...	36,000	72,840	25.7	47.2	Do.*
4707	...do.....	...do...	34,000	71,000	25.7	49.7	Do.*
4700	...do.....	Outside.	29,000	70,160	27.0	52.2	Do.†
4701	...do.....	Middle..	28,000	70,040	26.0	49.7	Do.†
4702	...do.....	...do...	27,000	68,560	25.7	49.7	Do.†
4703	...do.....	Inside..	29,000	71,560	23.7	52.2	Do.†

\* Breech end.

† Muzzle end.

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**12-INCH STEEL B. L. RIFLES.**

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**SPECIMENS FROM TUBES AND JACKETS.**

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TUBE NO. 2.

No. 962.

Marks, <sup>B T</sup><sub>R, T</sub>  
<sub>B T, M</sub>  
 Length, 5'".  
 Diameter, 1".128.  
 Sectional area, 1 square inch.  
 Gauged length, 4'".

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0.	0.	0.		
5,000	5,000	.000125	.000125	.....	.....		
10,000	10,000	.000250	.000125	.....	.....		
15,000	15,000	.000400	.000150	.....	.....		
20,000	20,000	.000575	.000175	.....	.....		
25,000	25,000	.000750	.000175	.....	.....		
30,000	30,000	.000925	.000175	0.	.....		
35,000	35,000	.001100	.000175	.....	.....		
40,000	40,000	.001300	.000200	0.	.....		
41,000	41,000	.001325	.000025	.....	.....		
42,000	42,000	.001375	.000050	.....	.....		
43,000	43,000	.001425	.000050	.....	.....		
44,000	44,000	.001475	.000050	.....	.....		
45,000	45,000	.001525	.000050	.....	.....		
46,000	46,000	.002125	.000000	.....	.....		
47,000	47,000	.004375	.002250	.....	.....		
48,000	48,000	.005250	.000875	.....	.....		
49,000	49,000	.006000	.000750	.....	.....		
50,000	50,000	.006425	.000425	.....	.....		
51,000	51,000	.007200	.000775	.....	.....		
52,000	52,000	.008150	.000950	.....	.....		
54,000	54,000	.010000	.001850	.....	.....		
56,000	56,000	.011550	.001550	.....	.....		
58,000	58,000	.013125	.001575	.....	.....		
60,000	60,000	.014300	.001175	.....	.....		
62,000	62,000	.016700	.002400	.....	.....		
64,000	64,000	.018250	.001550	.....	.....		
66,000	66,000	.020300	.002050	.....	.....		
68,000	68,000	.023175	.001875	.....	.....		
70,000	70,000	.024425	.002250	.....	.....		
100,700	100,700	.....	.....	.....	.....		Ultimate strength.

Failed by triple flexure.

## TUBE No. 3.

No. 989.

Marks, <sup>12 B, T</sup><sub>B T, M</sub>

Length, 5'.

Diameter, 1".118.

Sectional area, .982 square inch.

Gauged length, 4'.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
982	1,000	0.	0.	0.	0.	
4,910	5,000	.000060	.000050	0.	.....	
9,820	10,000	.000175	.000125	.....	.....	
14,730	15,000	.000300	.000125	.....	.....	
19,640	20,000	.000450	.000150	.....	.....	
24,550	25,000	.000600	.000150	.....	.....	
29,460	30,000	.000800	.000200	.....	.....	
34,370	35,000	.000950	.000150	0.	.....	
39,280	40,000	.001125	.000175	.000025	.000025	
40,282	41,000	.001175	.000050	.....	.....	
41,244	42,000	.001200	.000025	.....	.....	
42,226	43,000	.001250	.000050	.....	.....	
43,208	44,000	.001300	.000050	.....	.....	
44,190	45,000	.001350	.000050	.....	.....	
45,172	46,000	.001425	.000075	.....	.....	
46,154	47,000	.001475	.000050	.....	.....	
47,136	48,000	.002425	.000950	.....	.....	
48,118	49,000	.003000	.000575	.....	.....	
49,100	50,000	.003800	.000800	.002100	.002075	
51,064	52,000	.005175	.001375	.....	.....	
53,028	54,000	.006325	.001150	.....	.....	
54,992	56,000	.007875	.001550	.....	.....	
56,956	58,000	.009825	.001750	.....	.....	
58,920	60,000	.011000	.001375	.008800	.006700	
60,884	62,000	.012125	.001125	.....	.....	
62,848	64,000	.014000	.001875	.....	.....	
64,812	66,000	.015525	.001525	.....	.....	
66,776	68,000	.017075	.001550	.....	.....	
68,740	70,000	.019400	.002325	.016700	.007900	
101,600	103,460	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

TUBE NO. 5.

No. 4663.

Marks, <sup>12 R, T</sup>  
B T, M

Diameter, <sup>17</sup>563.

Sectional area, .25 square inch.

Gauged length, 3''.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total	Per square inch.					
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	0.	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.001000	.000367	.....	.....	
8,750	35,000	.001133	.000133	0.	.....	
10,000	40,000	.001400	.000287	.000067	.000067	
10,250	41,000	.001438	.000033	.....	.....	
10,500	42,000	.001533	.000100	.....	.....	
10,750	43,000	.001667	.000134	.....	.....	
11,000	44,000	.003667	.002000	.....	.....	
11,250	45,000	.004433	.000766	.....	.....	
11,500	46,000	.005667	.001234	.....	.....	Tensile strength.
21,640	86,560	.....	.....	.....	.....	

General summary.

Tensile strength per square inch of original section.....	pounds..	86,560
Elastic limit per square inch of original section.....	do..	41,000
Elongation per inch after rupture.....	inch..	.2167
Elongation per inch under strain at elastic limit.....	do..	.001433
Reduction in diameter at point of rupture.....	do..	.153
Reduction in area after rupture, per cent of original section.....		47.2
Position of rupture.....		1". 4 from neck
Character of broken surface.....		silky
Elongation of inch sections.....		".21, ".33, ".12

TUBE No. 5.

No. 4662.

Marks, <sup>12 R, T</sup><sub>M T, M</sub>  
 Diameter, ".564.  
 Sectional area, .25 square inch.  
 Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	0.	
2,500	10,000	.000300	.000233	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001133	.000166	0.	.....	
10,000	40,000	.001333	.000200	0.	.....	
10,250	41,000	.001367	.000034	.....	.....	
10,500	42,000	.001400	.000033	.....	.....	
10,750	43,000	.001433	.000033	.....	.....	
11,000	44,000	.001500	.000067	.....	.....	
11,250	45,000	.001533	.000033	.....	.....	
11,500	46,000	.001600	.000067	.....	.....	
11,750	47,000	.001633	.000033	.....	.....	
12,000	48,000	.001667	.000034	.....	.....	
12,250	49,000	.001700	.000033	.....	.....	Elastic limit.
12,500	50,000	.002333	.000633	.....	.....	
12,750	51,000	.003333	.001000	.....	.....	
13,000	52,000	.006000	.002667	.....	.....	
13,250	53,000	.006667	.000667	.....	.....	
13,500	54,000	.007400	.000733	.....	.....	
23,370	93,480	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section.....	pounds..	93,480
Elastic limit per square inch of original section.....	do..	49,000
Elongation per inch after rupture.....	inch..	.2133
Elongation per inch under strain at elastic limit.....	do..	.001700
Reduction in diameter at point of rupture.....	do..	.134
Reduction in area after rupture, per cent of original section.....	.....	41.9
Position of rupture.....	at middle of stem	
Character of broken surface.....	.....	silky
Elongation of inch sections.....	"14," "37," "13	

TUBE No. 7.

No. 4718.

Marks, <sup>13 R, T</sup>  
B T, M

Diameter, ".564.

Sectional area, .25 square inch.

Gauged length, 3''.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
250	1,000	0.	0.	0.	0.	
1,250	5,000	.000067	.000067	0.	0.	
2,500	10,000	.000233	.000166	.....	.....	
5,000	20,000	.000567	.000334	.....	.....	
7,500	30,000	.000900	.000333	.....	.....	
8,750	35,000	.001033	.000133	-.000033	-.000033	
10,000	40,000	.001300	.000267	-.000033	0.	
10,250	41,000	.001333	.000033	.....	.....	
10,500	42,000	.001367	.000034	.....	.....	
10,750	43,000	.001400	.000033	.....	.....	
11,000	44,000	.001433	.000033	.....	.....	
11,250	45,000	.001467	.000034	.....	.....	
11,500	46,000	.001533	.000066	.....	.....	
11,750	47,000	.001567	.000034	.....	.....	
12,000	48,000	.002333	.000766	.....	.....	
12,250	49,000	.002733	.001400	.....	.....	
12,500	50,000	.002733	.002000	.....	.....	
12,750	51,000	.002500	.000767	.....	.....	
13,000	52,000	.007333	.000833	.....	.....	
23,540	90,560	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section.....	pounds..	90,560
Elastic limit per square inch of original section.....	do..	47,000
Elongation per inch after rupture.....	inch..	.2209
Elongation per inch under strain at elastic limit.....	do..	.001567
Reduction in diameter at point of rupture.....	do..	.154
Reduction in area after rupture, per cent of original section.....		47.2
Position of rupture.....	1''.	4 from neck
Character of broken surface.....		silky
Elongation of inch sections.....	" 12, " 26, " 17	

## TUBE No. 7.

No. 4717.

Marks,  $\frac{12}{M} \frac{R}{T} \frac{T}{M}$ 

Diameter, ".564.

Sectional area, .25 square inch.

Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	0.	
2,500	10,000	.000300	.000233	0.	0.	
5,000	20,000	.000633	.000332	0.	0.	
7,500	30,000	.001000	.000387	0.	0.	
8,750	35,000	.001200	.000200	0.	0.	
10,000	40,000	.001367	.000167	0.	0.	
10,250	41,000	.001400	.000033	0.	0.	
10,500	42,000	.001433	.000033	0.	0.	
10,750	43,000	.001467	.000034	0.	0.	
11,000	44,000	.001533	.000066	0.	0.	
11,250	45,000	.001600	.000067	0.	0.	
11,500	46,000	.001633	.000033	0.	0.	
11,750	47,000	.001667	.000034	0.	0.	
12,000	48,000	.001700	.000033	0.	0.	
12,250	49,000	.001800	.000100	0.	0.	
12,500	50,000	.002867	.000867	0.	0.	
12,750	51,000	.005000	.002333	0.	0.	
13,000	52,000	.007867	.002867	0.	0.	
13,250	53,000	.008333	.000666	0.	0.	
21,560	86,240	.009067	.000784	0.	0.	Tensile strength.

## General summary.

Tensile strength per square inch of original section.....	pounds..	86,240
Elastic limit per square inch of original section.....	do....	48,000
Elongation per inch after rupture.....	inch....	.2167
Elongation per inch under strain at elastic limit.....	do....	.001700
Reduction in diameter at point of rupture.....	do....	.164
Reduction in area after rupture, per cent of original section.....	.....	49.7
Position of rupture.....	" .95 from neck	
Character of broken surface.....	silky	
Elongation of inch sections.....	" .11, ".16, ".28"	

JACKET NO. 3.

No. 963.

Marks, <sup>12R, J.</sup>  
BT, M.

Length, 5'.

Diameter, "1.127.

Sectional area, 1 square inch.

Gauged length, 4'.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
5,000	5,000	.000125	.000125	.....	.....	
10,000	10,000	.000250	.000125	.....	.....	
15,000	15,000	.000400	.000150	.....	.....	
20,000	20,000	.000550	.000150	.....	.....	
25,000	25,000	.000700	.000150	.....	.....	
30,000	30,000	.000875	.000175	0.	.....	
35,000	35,000	.001025	.000150	.....	.....	
40,000	40,000	.001250	.000225	0.	.....	
41,000	41,000	.001275	.000225	.....	.....	
42,000	42,000	.001325	.000050	.....	.....	
43,000	43,000	.001375	.000050	.....	.....	
44,000	44,000	.001400	.000025	.....	.....	
45,000	45,000	.001450	.000050	.....	.....	
46,000	46,000	.001575	.000125	.....	.....	
47,000	47,000	.002975	.001400	.....	.....	
48,000	48,000	.004100	.001125	.....	.....	
49,000	49,000	.004750	.000650	.....	.....	
50,000	50,000	.005200	.000450	.....	.....	
52,000	52,000	.006550	.001350	.....	.....	
54,000	54,000	.007925	.001375	.....	.....	
56,000	56,000	.009225	.001300	.....	.....	
58,000	58,000	.010450	.001225	.....	.....	
60,000	60,000	.011775	.001325	.....	.....	
62,000	62,000	.013250	.001475	.....	.....	
64,000	64,000	.014875	.001625	.....	.....	
66,000	66,000	.016450	.001575	.....	.....	
68,000	68,000	.017750	.001300	.....	.....	
70,000	70,000	.019625	.001375	.....	.....	
72,000	72,000	.021600	.001975	.....	.....	
74,000	74,000	.023200	.001600	.....	.....	
109,300	109,800	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

JACKET NO. 4.

No. 4622.

Marks, <sup>12 R, J</sup>  
<sub>B T, M</sub>  
 Diameter, ".564.

Sectional area, .25 square inch.

Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.		
2,500	10,000	.000267	.000167			
5,000	20,000	.000600	.000333			
7,500	30,000	.000933	.000333			
8,750	35,000	.001100	.000167	0.		
10,000	40,000	.001267	.000167			
10,500	42,000	.001333	.000066	0.		
10,750	43,000	.001367	.000034			
11,000	44,000	.001400	.000033			
11,250	45,000	.001433	.000033			
11,500	46,000	.001500	.000067			
11,750	47,000	.001567	.000067			
12,000	48,000	.001600	.000033			
12,250	49,000	.001633	.000033			
12,500	50,000	.001700	.000067			Elastic limit.
12,750	51,000	.001933	.000233			
13,000	52,000	.003167	.001234			
13,250	53,000	.003933	.000766			
13,500	54,000	.005000	.001067			Tensile strength.
13,750	55,000	.005867	.000867			
24,380	97,440					

General summary.

Tensile strength per square inch of original section.....	pounds..	97,440
Elastic limit per square inch of original section.....	do ..	50,000
Elongation per inch after rupture.....	inch.	.3033
Elongation per inch under strain at elastic limit.....	do...	.001700
Reduction in diameter at point of rupture.....	do...	0.144
Reduction in area after rupture, per cent of original section.....	do...	46.6
Position of rupture.....	"	9 from neck
Character of broken surface.....		silky
Elongation of inch sections.....	"	.31", ".17", ".13



## JACKET NO. 4.

No. 4620.

Marks, <sup>12 R, J</sup><sub>M T, M</sub>  
 Diameter, ".564.  
 Sectional area, .25 square inch.  
 Gauged length, 3".

Applied loads		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.	
250	1,000	0.	0.	0.	0.	Initial load,
1,250	5,000	.000100	.000100	0.	0.	
2,500	10,000	.000300	.000200	0.	0.	
5,000	20,000	.000833	.000333	0.	0.	
7,500	30,000	.001000	.000367	0.	0.	
8,750	35,000	.001100	.000100	0.	0.	
10,000	40,000	.001300	.000200	0.	0.	
10,500	42,000	.001367	.000067	0.	0.	
10,750	43,000	.001400	.000033	0.	0.	
11,000	44,000	.001433	.000033	0.	0.	
11,250	45,000	.001467	.000034	0.	0.	
11,500	46,000	.001500	.000033	0.	0.	
11,750	47,000	.001533	.000032	0.	0.	
12,000	48,000	.001567	.000034	0.	0.	
12,250	49,000	.001600	.000032	0.	0.	
12,500	50,000	.001667	.000067	0.	0.	Elastic limit.
12,750	51,000	.001667	.000000	0.	0.	
13,000	52,000	.002667	.000700	0.	0.	
13,250	53,000	.004000	.001333	0.	0.	
13,500	54,000	.005333	.001333	0.	0.	Tensile strength.
13,750	55,000	.006167	.000834	0.	0.	
23,810	95,240					

## General summary.

Tensile strength per square inch of original section ..... pounds.. 95,240  
 Elastic limit per square inch of original section..... do... 50,000  
 Elongation per inch after rupture..... inch... .1833  
 Elongation per inch under strain at elastic limit..... do... .001667  
 Reduction in diameter at point of rupture..... do... .144  
 Reduction in area after rupture, per cent of original section..... 44.6  
 Position of rupture..... "1.5 from neck  
 Character of broken surface..... granular, 60 per cent; silky, 40 per cent  
 Elongation of inch sections..... ".15, ".30, ".10

JACKET No. 4.

No. 4622.

Marks, <sup>12 R, J</sup><sub>BT, M</sub>

Diameter, <sup>12</sup>/<sub>16</sub> 564.

Sectional area, .25 square inch.

Gauged length, 3''.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.		
2,500	10,000	.000267	.000167			
5,000	20,000	.000600	.000333			
7,500	30,000	.000933	.000373			
8,750	35,000	.001100	.000167	0.		
10,000	40,000	.001267	.000167			
10,500	42,000	.001333	.000066	0.		
10,750	43,000	.001367	.000034			
11,000	44,000	.001400	.000033			
11,250	45,000	.001433	.000033			
11,500	46,000	.001500	.000067			
11,750	47,000	.001567	.000067			
12,000	48,000	.001600	.000033			
12,250	49,000	.001633	.000033			
12,500	50,000	.001700	.000067			Elastic limit.
12,750	51,000	.001933	.000233			
13,000	52,000	.002167	.001234			
13,250	53,000	.003933	.000766			
13,500	54,000	.005000	.001087			
13,750	55,000	.005887	.000887			
24,380	97,440					Tensile strength.

General summary.

Tensile strength per square inch of original section.....	pounds..	97,440
Elastic limit per square inch of original section.....	do ..	50,000
Elongation per inch after rupture.....	inch.	.2083
Elongation per inch under strain at elastic limit.....	do ..	.001700
Reduction in diameter at point of rupture.....	do ..	0.144
Reduction in area after rupture, per cent of original section.....	do ..	46.6
Position of rupture.....		.9 from neck
Character of broken surface.....		silky
Elongation of inch sections.....		".31", ".17", ".13

JACKET NO. 4.

No. 4620.

Marks, <sup>12 R, J</sup><sub>M T, M</sub>  
 Diameter, ".564.  
 Sectional area, .25 square inch.  
 Gauged length, 3".

Applied loads		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
250	1,000	0.	0.	0.	0.	Initial load,
1,250	5,000	.000100	.000100	0.	0.	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000933	.000333	.....	.....	
7,500	30,000	.001000	.000387	.....	.....	
8,750	35,000	.001100	.000400	0.	.....	
10,000	40,000	.001300	.000200	.....	.....	
10,500	42,000	.001387	.000087	0.	.....	
10,750	43,000	.001400	.000033	.....	.....	
11,000	44,000	.001433	.000033	.....	.....	
11,250	45,000	.001487	.000034	.....	.....	
11,500	46,000	.001500	.000033	.....	.....	
11,750	47,000	.001533	.000033	.....	.....	
12,000	48,000	.001587	.000034	.....	.....	
12,250	49,000	.001600	.000033	.....	.....	
12,500	50,000	.001687	.000087	.....	.....	Elastic limit.
12,750	51,000	.001687	.000000	.....	.....	
18,000	52,000	.002687	.000700	.....	.....	
13,250	53,000	.004000	.001333	.....	.....	
13,500	54,000	.005333	.001333	.....	.....	Tensile strength.
13,750	55,000	.006167	.000834	.....	.....	
23,810	95,240	.....	.....	.....	.....	

General summary.

Tensile strength per square inch of original section ..... pounds.. 95,240  
 Elastic limit per square inch of original section ..... do... 50,000  
 Elongation per inch after rupture ..... inch... .1833  
 Elongation per inch under strain at elastic limit ..... do... .001687  
 Reduction in diameter at point of rupture ..... do... .144  
 Reduction in area after rupture, per cent of original section ..... 44.6  
 Position of rupture ..... "1.5 from neck  
 Character of broken surface ..... granular, 60 per cent; silky, 40 per cent  
 Elongation of inch sections ..... "15, "30, "10

## JACKET NO. 4.

No. 4622.

Marks, <sup>12 R, J</sup><sub>B T, M</sub>

Diameter, ".564.

Sectional area, .25 square inch.

Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.		
2,500	10,000	.000267	.000167			
5,000	20,000	.000600	.000333			
7,500	30,000	.000933	.000333			
8,750	35,000	.001100	.000167	0.		
10,000	40,000	.001267	.000167			
10,500	42,000	.001333	.000066	0.		
10,750	43,000	.001367	.000034			
11,000	44,000	.001400	.000033			
11,250	45,000	.001433	.000033			
11,500	46,000	.001500	.000067			
11,750	47,000	.001567	.000067			
12,000	48,000	.001600	.000033			
12,250	49,000	.001633	.000033			
12,500	50,000	.001700	.000067			Elastic limit.
12,750	51,000	.001933	.000233			
13,000	52,000	.002167	.001234			
13,250	53,000	.003933	.000766			
13,500	54,000	.005000	.001067			
13,750	55,000	.005867	.000867			Tensile strength.
24,380	97,440					

*General summary.*

Tensile strength per square inch of original section.....pounds.. 97,440  
 Elastic limit per square inch of original section.....do... 50,000  
 Elongation per inch after rupture.....inch. .2683  
 Elongation per inch under strain at elastic limit.....do.... .001700  
 Reduction in diameter at point of rupture.....do.... 0.144  
 Reduction in area after rupture, per cent of original section.....do.... 46.6  
 Position of rupture.....".9 from neck  
 Character of broken surface.....silky  
 Elongation of inch sections.....".31", ".17", ".13

## JACKET NO. 4.

No. 4620.

Marks, <sup>12 R, J</sup><sub>M T, M</sub>  
 Diameter, ".564.  
 Sectional area, .25 square inch.  
 Gauged length, 3".

Applied loads		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.	
250	1,000	0.	0.	0.	0.	Initial load,
1,250	5,000	.000100	.000100	0.	0.	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.001000	.000667	.....	.....	
8,750	35,000	.001100	.000100	0.	.....	
10,000	40,000	.001300	.000200	.....	.....	
10,500	42,000	.001367	.000067	0.	.....	
10,750	43,000	.001400	.000033	.....	.....	
11,000	44,000	.001433	.000033	.....	.....	
11,250	45,000	.001467	.000034	.....	.....	
11,500	46,000	.001500	.000033	.....	.....	
11,750	47,000	.001533	.000033	.....	.....	
12,000	48,000	.001567	.000034	.....	.....	
12,250	49,000	.001600	.000033	.....	.....	
12,500	50,000	.001667	.000067	.....	.....	Elastic limit.
12,750	51,000	.001667	.000100	.....	.....	
13,000	52,000	.002867	.000700	.....	.....	
13,250	53,000	.004000	.001333	.....	.....	Tensile strength.
13,500	54,000	.005333	.001333	.....	.....	
13,750	55,000	.000167	.000834	.....	.....	
23,810	95,240	.....	.....	.....	.....	

## General summary.

Tensile strength per square inch of original section ..... pounds.. 95,240  
 Elastic limit per square inch of original section..... do... 50,000  
 Elongation per inch after rupture..... inch... .1833  
 Elongation per inch under strain at elastic limit..... do... .001667  
 Reduction in diameter at point of rupture..... do... .144  
 Reduction in area after rupture, per cent of original section..... do... 44.6  
 Position of rupture..... "1.5 from neck  
 Character of broken surface..... granular, 60 per cent; silky, 40 per cent  
 Elongation of inch sections..... ".15, ".30, ".10

## JACKET NO. 4.

No. 4621.

Marks, <sup>12 R, J.</sup><sub>M T, M.</sub>

Diameter, ".564.

Sectional area, .25 square inch.

Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
250	1,000	0.	9.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	0.	
2,500	10,000	.000267	.000187	0.	0.	
5,000	20,000	.000600	.000333	0.	0.	
7,500	30,000	.000933	.000333	0.	0.	
8,750	35,000	.001100	.000267	0.	0.	
10,000	40,000	.001300	.000200	0.	0.	
10,500	42,000	.001367	.000087	0.	0.	
10,750	43,000	.001400	.000033	0.	0.	
11,000	44,000	.001467	.000007	0.	0.	
11,250	45,000	.001500	.000033	0.	0.	Elastic limit.
11,500	46,000	.001567	.000067	0.	0.	
11,750	47,000	.001767	.000200	0.	0.	
12,000	48,000	.003733	.001966	0.	0.	
12,250	49,000	.004667	.000934	0.	0.	
12,500	50,000	.005500	.000833	0.	0.	Tensile strength.
12,750	51,000	.006267	.000767	0.	0.	
22,930	91,720	.....	.....	.....	.....	

*General summary.*

Tensile strength per square inch of original section .....	pounds..	91,720
Elastic limit per square inch of original section .....	do.	46,000
Elongation per inch after rupture .....	inch..	.2167
Elongation per inch under strain at elastic limit .....	do.	.001567
Reduction in diameter at point of rupture .....	do.	.134
Reduction in area after rupture, per cent of original section .....		41.9
Position of rupture .....		".2 from middle of stem
Character of broken surface .....		silky, 60 per cent; granular, 40 per cent
Elongation of inch sections .....		".15, ".35*, ".15

## 12-INCH STEEL B. L. RIFLES.

## CHEMICAL COMPOSITION OF TUBE No. 2, AND JACKET No. 3.

Compression-test number.	Number of Rifle.	Position in Rifle.	Carbon.			Manganese.	Silicon.	Sulphur.	Phosphorus.
			Total.	Graphitic.	Combined.				
962	2	Tube ..	0.252	0.027	0.225	0.672	0.154	0.030	0.025
963	3	Jacket..	0.306	0.009	0.297	0.638	0.150	0.026	0.022

## 12-INCH STEEL B. L. RIFLES.

## SPECIFIC GRAVITY AND HARDNESS OF TUBES, JACKETS, AND HOOPS.

No tension tests of these specimens.

Number of Rifle.	Position in Rifle.	Marks on specimen.	Specific gravity.	Hardness.
2	Tube .....	12 R <sub>2</sub> T—B R <sub>2</sub> M .....	7.8550	16.73
3	do .....	12 R <sub>3</sub> T—B R <sub>3</sub> M .....	7.8563	19.39
3	Jacket .....	12 R <sub>3</sub> J—B R <sub>3</sub> M .....	7.8542	18.58
2	Hoop .....	12 R <sub>2</sub> A <sub>2</sub> —B R <sub>2</sub> M .....	7.8334	23.84
3	do .....	12 R <sub>3</sub> A <sub>3</sub> —R <sub>3</sub> M .....	7.8611	22.14

## Tabulation of Tension specimens from 12-inch Steel B. L. Rifles.

[Stems 3 inches long, ".564 diameter.]

No. of test.	Position in gun.	Location of specimens.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation.	Contraction of area.	Appearance of fracture.
4663	Tube No. 5 .....	Middle ..	<i>Pounds.</i> 41,000	<i>Pounds.</i> 86,560	<i>Pr. ct.</i> 21.7	<i>Pr. ct.</i> 47.2	Silky.*
4662	do .....	do .....	49,000	93,480	21.3	41.9	Do.†
4718	Tube No. 7 .....	do .....	47,000	90,560	22.0	47.2	Do.*
4717	do .....	do .....	48,000	86,240	21.7	49.7	Do.†
4622	Jacket No. 4 .....	Middle ..	50,000	97,440	20.3	46.6	Silky.*
4620	do .....	do .....	50,000	95,240	18.3	44.6	Granular, 60 per cent; silky, 40 per cent.†
4621	do .....	do .....	46,000	91,720	21.7	41.9	Granular, 40 per cent; silky, 60 per cent.†

\* Breech end.

† Muzzle end.

## Tabulation of Compression specimens from 12-inch Steel B. L. Rifles.

No. of test.	Position in gun.	Location of specimens.	Elastic limit per square inch.	Ultimate strength per square inch.	Manner of failure.
962	Tube No. 2 .....	Middle .....	<i>Pounds.</i> 45,000	<i>Pounds.</i> 100,700	Triple flexure*
969	Tube No. 3 .....	do .....	47,000	103,460	Do.*
963	Jacket No. 3 .....	Middle .....	45,000	109,300	Do.*

\* Breech end.





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**12-INCH B. L. RIFLED MORTARS.**

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**SPECIMENS FROM CAST-IRON BODIES.**

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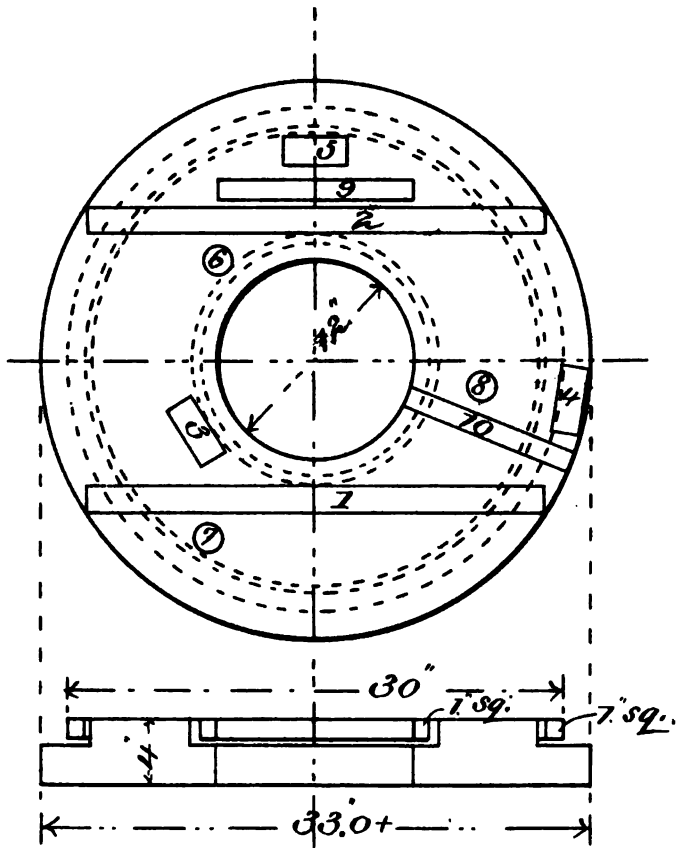
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# 12-inch B.L. Rifled Mortars

## Cast iron Bodies

### Breech end

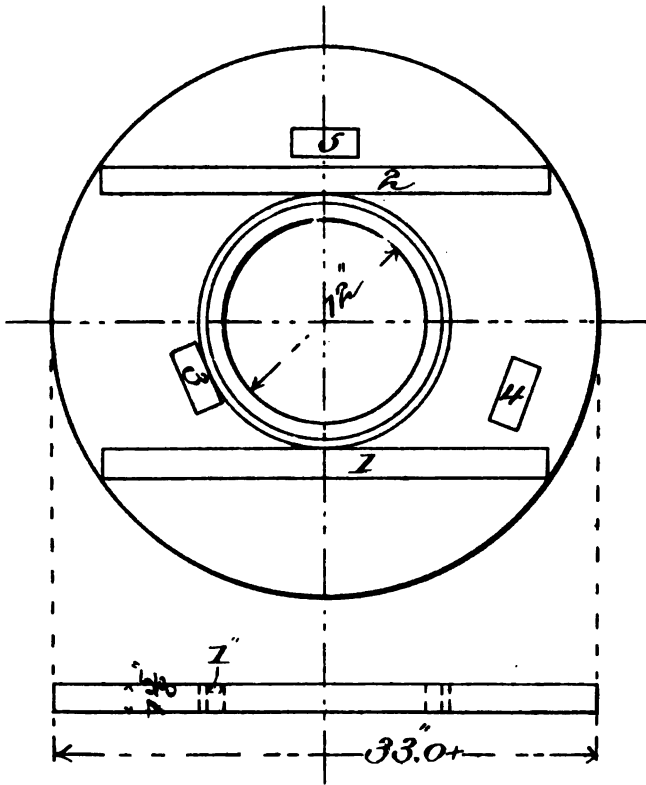




*12-inch B.L. Rifled Mortars*

*Cast iron Bodies*

*Muzzle end*

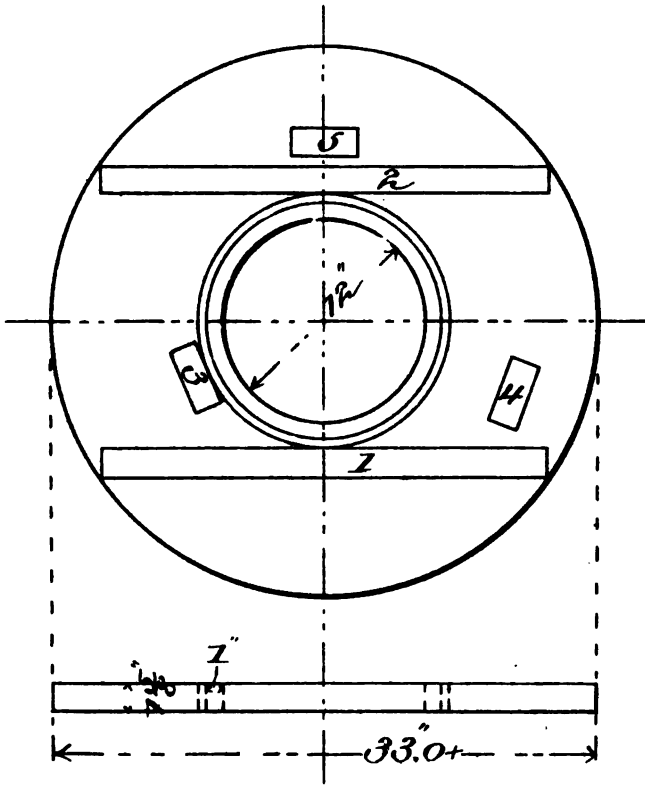




*12-inch B.L. Rifled Mortars*

*Cast iron Bodies*

*Muzzle end*



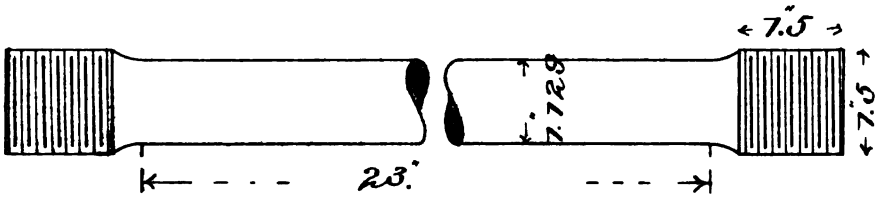




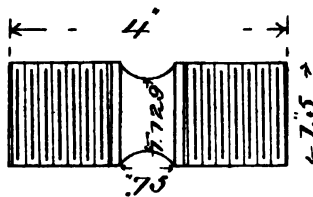
# 12-inch B.L. Rifled Mortars

## Forms of specimens

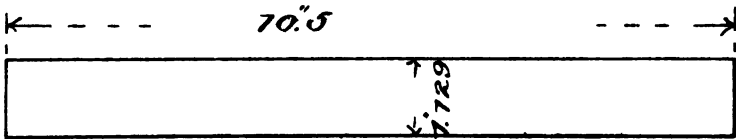
### Tension



### Tenacity



### Compression





Body No. 2 (second casting).

No. 4527.

Marks, <sup>12</sup>M R, T R,  
B T<sub>1</sub>

Diameter, 1<sup>11</sup>/<sub>16</sub>.129.

Sectional area, 1 square inch.

Gauged length, 20<sup>1</sup>/<sub>2</sub>.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.000050	.000050	.....	.....	
3,000	3,000	.000100	.000050	.....	.....	
4,000	4,000	.000150	.000050	.....	.....	
5,000	5,000	.000205	.000055	0.	.....	
6,000	6,000	.000260	.000055	.....	.....	
7,000	7,000	.000315	.000055	.....	.....	
8,000	8,000	.000380	.000065	.....	.....	
9,000	9,000	.000450	.000070	.....	.....	
10,000	10,000	.000510	.000060	.000020	.000020	
11,000	11,000	.000580	.000070	.....	.....	
12,000	12,000	.000660	.000080	.000050	.000030	
13,000	13,000	.000750	.000090	.....	.....	
14,000	14,000	.000835	.000085	.000090	.000040	
15,000	15,000	.000920	.000085	.....	.....	
16,000	16,000	.001020	.000100	.000150	.000080	
17,000	17,000	.001145	.000125	.....	.....	
18,000	18,000	.001280	.000115	.000245	.000095	
19,000	19,000	.001420	.000160	.....	.....	
20,000	20,000	.001575	.000155	.000400	.000155	
21,000	21,000	.001790	.000215	.....	.....	
22,000	22,000	.002040	.000250	.000800	.000290	
23,000	23,000	.002325	.000285	.....	.....	
24,000	24,000	.002650	.000325	.001135	.000445	
25,000	25,000	.003140	.000490	.....	.....	
						Tensile strength.

Fractured 6 inches from neck. Appearance, uniform; granular.

No. 4523.

Marks, <sup>12 M R, T B<sub>1</sub></sup>  
<sup>M T<sub>11</sub></sup>  
 Diameter, 1".129.  
 Sectional area, 1 square inch.  
 Gauged length, 20".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.000045	.000045	-----	-----	
3,000	3,000	.000090	.000045	-----	-----	
4,000	4,000	.000140	.000050	-----	-----	
5,000	5,000	.000190	.000050	0.	-----	
6,000	6,000	.000235	.000045	-----	-----	
7,000	7,000	.000285	.000050	-----	-----	
8,000	8,000	.000335	.000050	-----	-----	
9,000	9,000	.000385	.000050	-----	-----	
10,000	10,000	.000445	.000060	.000005	.000005	
11,000	11,000	.000500	.000055	-----	-----	
12,000	12,000	.000555	.000055	.000010	.000005	
13,000	13,000	.000625	.000070	-----	-----	
14,000	14,000	.000690	.000065	.000035	.000025	
15,000	15,000	.000750	.000060	-----	-----	
16,000	16,000	.000825	.000075	.000060	.000025	
17,000	17,000	.000900	.000075	-----	-----	
18,000	18,000	.000970	.000070	.000095	.000035	
19,000	19,000	.001060	.000090	-----	-----	
20,000	20,000	.001150	.000090	.000150	.000055	
21,000	21,000	.001255	.000105	-----	-----	
22,000	22,000	.001380	.000125	.000240	.000060	
23,000	23,000	.001500	.000120	-----	-----	
24,000	24,000	.001655	.000155	.000380	.000140	
25,000	25,000	.001850	.000195	.000500	.000120	
30,780	30,780	-----	-----	-----	-----	Tensile strength.

Fractured 1" from neck. Appearance, uniform, granular.

No. 964.

Marks, <sup>12</sup>M R<sub>1</sub> T R,  
<sup>B T<sub>12</sub></sup>  
 Length, 10''.5.  
 Diameter, 1''.129.  
 Sectional area, 1 square inch.  
 Gauged length, 5''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0.	0.	0.		
2,000	2,000	.00006	.00006	.....	.....		
3,000	3,000	.00012	.00006	.....	.....		
4,000	4,000	.00016	.00004	.....	.....		
5,000	5,000	.00022	.00006	0.	.....		
6,000	6,000	.00028	.00006	.....	.....		
7,000	7,000	.00032	.00004	.....	.....		
8,000	8,000	.00038	.00006	.....	.....		
9,000	9,000	.00044	.00006	.....	.....		
10,000	10,000	.00048	.00004	.....	.....		
11,000	11,000	.00054	.00006	.....	.....		
12,000	12,000	.00060	.00006	.....	.....		
13,000	13,000	.00066	.00006	.....	.....		
14,000	14,000	.00072	.00006	.....	.....		
15,000	15,000	.00078	.00006	.00001	.00004		
16,000	16,000	.00084	.00006	.....	.....		
17,000	17,000	.00090	.00006	.....	.....		
18,000	18,000	.00100	.00010	.....	.....		
19,000	19,000	.00106	.00006	.....	.....		
20,000	20,000	.00110	.00004	.00010	.00006		
21,000	21,000	.00120	.00010	.....	.....		
22,000	22,000	.00130	.00010	.....	.....		
23,000	23,000	.00136	.00006	.....	.....		
24,000	24,000	.00144	.00008	.....	.....		
25,000	25,000	.00154	.00010	.00026	.00016		
26,000	26,000	.00166	.00012	.....	.....		
27,000	27,000	.00176	.00010	.....	.....		
28,000	28,000	.00186	.00010	.....	.....		
29,000	29,000	.00198	.00012	.....	.....		
30,000	30,000	.00220	.00022	.00040	.00014		
31,000	31,000	.00232	.00012	.....	.....		
32,000	32,000	.00248	.00016	.....	.....		
33,000	33,000	.00270	.00022	.....	.....		
34,000	34,000	.00302	.00032	.....	.....		
35,000	35,000	.00340	.00038	.00155	.00116		
36,000	36,000	.00378	.00038	.....	.....		
37,000	37,000	.00410	.00032	.....	.....		
38,000	38,000	.00456	.00046	.....	.....		
39,000	39,000	.00500	.00044	.....	.....		
40,000	40,000	.00550	.00050	.00336	.00190		
41,000	41,000	.00600	.00050	.....	.....		
42,000	42,000	.00646	.00046	.....	.....		
43,000	43,000	.00710	.00064	.....	.....		
44,000	44,000	.00776	.00066	.....	.....		
45,000	45,000	.00856	.00080	.00600	.00294		
46,000	46,000	.00900	.00044	.....	.....		
47,000	47,000	.00958	.00058	.....	.....		
48,000	48,000	.01042	.00084	.....	.....		
49,000	49,000	.01154	.00112	.....	.....		
50,000	50,000	.01248	.00094	.00950	.00350		
59,280	59,280	.....	.....	.....	.....		Ultimate strength.

Failed by triple flexure.

No. 965.

Marks, <sup>12 M R, T R,</sup>  
<sub>B R<sub>20</sub></sub>  
 Length, 10''<sup>5</sup>.  
 Diameter, 1''<sup>129</sup>.  
 Sectional area, 1 square inch.  
 Gauged length, 5''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.00004	.00004	.....	.....	
3,000	3,000	.00008	.00004	.....	.....	
4,000	4,000	.00014	.00006	.....	.....	
5,000	5,000	.00018	.00004	0.	.....	
6,000	6,000	.00024	.00006	.....	.....	
7,000	7,000	.00030	.00008	.....	.....	
8,000	8,000	.00034	.00004	.....	.....	
9,000	9,000	.00040	.00006	.....	.....	
10,000	10,000	.00046	.00006	.00002	.00002	
11,000	11,000	.00052	.00006	.....	.....	
12,000	12,000	.00058	.00006	.....	.....	
13,000	13,000	.00064	.00006	.....	.....	
14,000	14,000	.00072	.00008	.....	.....	
15,000	15,000	.00080	.00008	.00004	.00002	
16,000	16,000	.00084	.00004	.....	.....	
17,000	17,000	.00088	.00004	.....	.....	
18,000	18,000	.00092	.00004	.....	.....	
19,000	19,000	.00098	.00006	.....	.....	
20,000	20,000	.00104	.00006	.00008	.00004	
21,000	21,000	.00110	.00006	.....	.....	
22,000	22,000	.00118	.00008	.....	.....	
23,000	23,000	.00126	.00008	.....	.....	
24,000	24,000	.00136	.00010	.....	.....	
25,000	25,000	.00146	.00010	.00020	.00012	
26,000	26,000	.00158	.00012	.....	.....	
27,000	27,000	.00170	.00012	.....	.....	
28,000	28,000	.00182	.00012	.....	.....	
29,000	29,000	.00196	.00014	.....	.....	
30,000	30,000	.00212	.00016	.00062	.00042	
31,000	31,000	.00234	.00022	.....	.....	
32,000	32,000	.00256	.00022	.....	.....	
33,000	33,000	.00282	.00026	.....	.....	
34,000	34,000	.00310	.00028	.....	.....	
35,000	35,000	.00350	.00040	.00174	.00114	
36,000	36,000	.00380	.00030	.....	.....	
37,000	37,000	.00420	.00040	.....	.....	
38,000	38,000	.00466	.00046	.....	.....	
39,000	39,000	.00526	.00060	.....	.....	
40,000	40,000	.00570	.00044	.00300	.00186	
41,000	41,000	.00618	.00048	.....	.....	
42,000	42,000	.00670	.00052	.....	.....	
43,000	43,000	.00716	.00046	.....	.....	
44,000	44,000	.00778	.00062	.....	.....	
45,000	45,000	.00830	.00052	.00500	.00230	
46,000	46,000	.00884	.00054	.....	.....	
47,000	47,000	.00924	.00040	.....	.....	
48,000	48,000	.00974	.00050	.....	.....	
49,000	49,000	.01020	.00046	.....	.....	
50,000	50,000	.01060	.00040	.00794	.00204	
58,470	58,470	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

No. 966.

Marks, <sup>12 M R, T R,</sup>  
<sub>M T</sub>  
 Length, 10' <sup>1</sup>/<sub>5</sub>.  
 Diameter, 1" <sup>1</sup>/<sub>29</sub>.  
 Sectional area, 1 square inch.  
 Gauged length, 5".

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.00006	.00006	.....	.....	
3,000	3,000	.00012	.00008	.....	.....	
4,000	4,000	.00016	.00004	.....	.....	
5,000	5,000	.00020	.00004	0.	.....	
6,000	6,000	.00024	.00004	.....	.....	
7,000	7,000	.00028	.00004	.....	.....	
8,000	8,000	.00032	.00004	.....	.....	
9,000	9,000	.00036	.00006	.....	.....	
10,000	10,000	.00042	.00004	.00002	.00002	
11,000	11,000	.00050	.00008	.....	.....	
12,000	12,000	.00056	.00008	.....	.....	
13,000	12,000	.00062	.00006	.....	.....	
14,000	14,000	.00068	.00006	.....	.....	
15,000	15,000	.00076	.00008	.00006	.00004	
16,000	16,000	.00080	.00004	.....	.....	
17,000	17,000	.00084	.00004	.....	.....	
18,000	18,000	.00090	.00006	.....	.....	
19,000	19,000	.00096	.00008	.....	.....	
20,000	20,000	.00102	.00004	.00012	.00006	
21,000	21,000	.00108	.00008	.....	.....	
22,000	22,000	.00114	.00006	.....	.....	
23,000	23,000	.00120	.00006	.....	.....	
24,000	24,000	.00130	.00010	.....	.....	
25,000	25,000	.00136	.00006	.00020	.00008	
26,000	26,000	.00144	.00008	.....	.....	
27,000	27,000	.00152	.00008	.....	.....	
28,000	28,000	.00160	.00008	.....	.....	
29,000	29,000	.00170	.00010	.....	.....	
30,000	30,000	.00180	.00010	.00040	.00020	
31,000	31,000	.00192	.00012	.....	.....	
32,000	32,000	.00202	.00010	.....	.....	
33,000	33,000	.00216	.00014	.....	.....	
34,000	34,000	.00234	.00018	.....	.....	
35,000	35,000	.00254	.00020	.00082	.00042	
36,000	36,000	.00280	.00026	.....	.....	
37,000	37,000	.00302	.00022	.....	.....	
38,000	38,000	.00330	.00028	.....	.....	
39,000	39,000	.00358	.00028	.....	.....	
40,000	40,000	.00400	.00042	.00200	.00118	
41,000	41,000	.00440	.00040	.....	.....	
42,000	42,000	.00484	.00024	.....	.....	
43,000	43,000	.00500	.00036	.....	.....	
44,000	44,000	.00550	.00050	.....	.....	
45,000	45,000	.00590	.00040	.00360	.00160	
46,000	46,000	.00636	.00046	.....	.....	
47,000	47,000	.00678	.00042	.....	.....	
48,000	48,000	.00718	.00040	.....	.....	
49,000	49,000	.00746	.00028	.....	.....	
50,000	50,000	.00780	.00084	.00530	.00170	
60,870	60,870	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

## BODY No. 4.

No. 4529.

Marks, 12 M R, T R,

Diameter, 1<sup>B T</sup> 1/29.

Sectional area, 1 square inch.

Length of stem, 23<sup>1/2</sup>.Gauged length, 20<sup>1/2</sup>.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.000050	.000050	-----	-----	
3,000	3,000	.000100	.000050	-----	-----	
4,000	4,000	.000150	.000050	-----	-----	
5,000	5,000	.000205	.000055	.000005	.000005	
6,000	6,000	.000280	.000055	-----	-----	
7,000	7,000	.000315	.000055	-----	-----	
8,000	8,000	.000380	.000065	-----	-----	
9,000	9,000	.000445	.000065	-----	-----	
10,000	10,000	.000505	.000060	.000035	.000030	
11,000	11,000	.000575	.000070	-----	-----	
12,000	12,000	.000645	.000070	.000050	.000015	
13,000	13,000	.000720	.000075	-----	-----	
14,000	14,000	.000795	.000075	.000085	.000035	
15,000	15,000	.000880	.000085	-----	-----	
16,000	16,000	.000980	.000080	.000130	.000045	
17,000	17,000	.001065	.000095	-----	-----	
18,000	18,000	.001160	.000105	.000195	.000065	
19,000	19,000	.001295	.000135	-----	-----	
20,000	20,000	.001415	.000120	.000305	.000110	
21,000	21,000	.001595	.000130	-----	-----	
22,000	22,000	.001775	.000130	.000505	.000200	
23,000	23,000	.002010	.000235	-----	-----	
24,000	24,000	.002285	.000275	.000845	.000340	
24,930	24,930	-----	-----	-----	-----	Tensile strength.

Fractured 6<sup>1/2</sup> from neck. Appearance, uniform, granular.



No. 4530.

Marks, <sup>12 M R, T R,</sup>  
<sup>M T,</sup>  
 Diameter, 1<sup>11</sup>/<sub>129</sub>.  
 Sectional area, 1 square inch.  
 Length of stem, 23<sup>11</sup>/<sub>16</sub>.  
 Gauged length, 20<sup>11</sup>/<sub>16</sub>.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.000050	.000050	.....	.....	
3,000	3,000	.000100	.000050	.....	.....	
4,000	4,000	.000150	.000050	.....	.....	
5,000	5,000	.000200	.000050	0.	.....	
6,000	6,000	.000250	.000050	.....	.....	
7,000	7,000	.000300	.000050	.....	.....	
8,000	8,000	.000355	.000055	.....	.....	
9,000	9,000	.000405	.000050	.....	.....	
10,000	10,000	.000465	.000060	.000005	.000005	
11,000	11,000	.000540	.000075	.....	.....	
12,000	12,000	.000595	.000055	.000035	.000030	
13,000	13,000	.000655	.000060	.....	.....	
14,000	14,000	.000710	.000055	.000050	.000015	
15,000	15,000	.000795	.000085	.....	.....	
16,000	16,000	.000860	.000085	.000065	.000015	
17,000	17,000	.000940	.000080	.....	.....	
18,000	18,000	.001010	.000070	.000110	.000045	
19,000	19,000	.001110	.000100	.....	.....	
20,000	20,000	.001205	.000095	.000160	.000070	
21,000	21,000	.001310	.000105	.....	.....	
22,000	22,000	.001435	.000125	.000200	.000060	
23,000	23,000	.001575	.000140	.....	.....	
24,000	24,000	.001740	.000165	.000450	.000190	
25,000	25,000	.001935	.000195	.000565	.000115	
26,410	26,410	.....	.....	.....	.....	Tensile strength.

Fractured 1<sup>11</sup>/<sub>16</sub> from middle of stem. Appearance, uniform, granular.

No. 967.

Marks, 12 M R, T R,  
 B T,  
 Length, 10'' .5,  
 Diameter, 1'' .129.  
 Sectional area, 1 square inch.  
 Gauged length, 5''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0.	0.	0.		
2,000	2,000	.00005	.00005	.....	.....		
3,000	3,000	.00010	.00005	.....	.....		
4,000	4,000	.00014	.00014	.....	.....		
5,000	5,000	.00018	.00004	0.	.....		
6,000	6,000	.00022	.00004	.....	.....		
7,000	7,000	.00028	.00004	.....	.....		
8,000	8,000	.00030	.00004	.....	.....		
9,000	9,000	.00038	.00006	.....	.....		
10,000	10,000	.00040	.00004	0.	.....		
11,000	11,000	.00048	.00006	.....	.....		
12,000	12,000	.00050	.00004	.....	.....		
13,000	13,000	.00058	.00006	.....	.....		
14,000	14,000	.00060	.00004	.....	.....		
15,000	15,000	.00068	.00006	0.	.....		
16,000	16,000	.00074	.00008	.....	.....		
17,000	17,000	.00078	.00002	.....	.....		
18,000	18,000	.00082	.00006	.....	.....		
19,000	19,000	.00086	.00004	.....	.....		
20,000	20,000	.00094	.00008	.00002	.00002		
21,000	21,000	.00104	.00010	.....	.....		
22,000	22,000	.00108	.00004	.....	.....		
23,000	23,000	.00114	.00006	.....	.....		
24,000	24,000	.00120	.00006	.....	.....		
25,000	25,000	.00124	.00004	.00006	.00004		
26,000	26,000	.00132	.00008	.....	.....		
27,000	27,000	.00144	.00012	.....	.....		
28,000	28,000	.00152	.00008	.....	.....		
29,000	29,000	.00166	.00014	.....	.....		
30,000	30,000	.00176	.00010	.00028	.00022		
31,000	31,000	.00186	.00020	.....	.....		
32,000	32,000	.00210	.00014	.....	.....		
33,000	33,000	.00234	.00024	.....	.....		
34,000	34,000	.00256	.00022	.....	.....		
35,000	35,000	.00290	.00034	.00114	.00088		
36,000	36,000	.00310	.00020	.....	.....		
37,000	37,000	.00340	.00030	.....	.....		
38,000	38,000	.00376	.00036	.....	.....		
39,000	39,000	.00424	.00048	.....	.....		
40,000	40,000	.00476	.00052	.00270	.00156		
41,000	41,000	.00516	.00040	.....	.....		
42,000	42,000	.00546	.00030	.....	.....		
43,000	43,000	.00602	.00056	.....	.....		
44,000	44,000	.00664	.00062	.....	.....		
45,000	45,000	.00704	.00040	.000470	.00200		
46,000	46,000	.00756	.00052	.....	.....		
47,000	47,000	.00796	.00040	.....	.....		
48,000	48,000	.00850	.00054	.....	.....		
49,000	49,000	.00898	.00048	.....	.....		
50,000	50,000	.00968	.00070	.00700	.00230		
63,100	63,100	.....	.....	.....	.....		Ultimate strength.

Failed by triple flexure.

No. 968.

Marks,  $12 M R_1 T E_2$   
 $B R_1$

Length, 10'' .5.

Diameter, 1'' .129.

Sectional area, 1 square inch.

Gauged length, 5''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0.	0.	0.		
2,000	2,000	.00008	.00008				
3,000	3,000	.00012	.00004				
4,000	4,000	.00016	.00004				
5,000	5,000	.00020	.00004	.00004	.00004		
6,000	6,000	.00026	.00006				
7,000	7,000	.00032	.00006				
8,000	8,000	.00036	.00004				
9,000	9,000	.00042	.00006				
10,000	10,000	.00048	.00006	.00006	.00002		
11,000	11,000	.00054	.00006				
12,000	12,000	.00060	.00006				
13,000	13,000	.00066	.00006				
14,000	14,000	.00070	.00004				
15,000	15,000	.00076	.00006	.00010	.00004		
16,000	16,000	.00082	.00006				
17,000	17,000	.00088	.00006				
18,000	18,000	.00096	.00006				
19,000	19,000	.00100	.00004				
20,000	20,000	.00108	.00008	.00016	.00006		
21,000	21,000	.00116	.00008				
22,000	22,000	.00122	.00006				
23,000	23,000	.00130	.00008				
24,000	24,000	.00138	.00008				
25,000	25,000	.00146	.00008	.00026	.00010		
26,000	26,000	.00154	.00008				
27,000	27,000	.00160	.00006				
28,000	28,000	.00170	.00010				
29,000	29,000	.00188	.00018				
30,000	30,000	.00200	.00012	.00050	.00030		
31,000	31,000	.00216	.00016				
32,000	32,000	.00240	.00024				
33,000	33,000	.00260	.00020				
34,000	34,000	.00292	.00032				
35,000	35,000	.00330	.00038	.00154	.00098		
36,000	36,000	.00366	.00036				
37,000	37,000	.00400	.00034				
38,000	38,000	.00442	.00042				
39,000	39,000	.00480	.00038				
40,000	40,000	.00530	.00050	.00330	.00176		
41,000	41,000	.00566	.00066				
42,000	42,000	.00630	.00084				
43,000	43,000	.00692	.00062				
44,000	44,000	.00760	.00068				
45,000	45,000	.00820	.00080	.00576	.00246		
46,000	46,000	.00870	.00050				
47,000	47,000	.00940	.00070				
48,000	48,000	.01006	.00066				
49,000	49,000	.01100	.00094				
50,000	50,000	.01218	.00118	.00338	.00362		
60,100	60,100						Ultimate strength.

Failed by triple flexure.

No. 969.

Marks, <sup>12</sup>M R, T B,  
<sub>M T,</sub>Length, 10''<sup>1</sup>/<sub>5</sub>.Diameter, 1''<sup>1</sup>/<sub>129</sub>.

Sectional area, 1 square inch.

Gauged length, 5''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0.	0.	0.		
2,000	2,000	.00006	.00006	0.	.....		
3,000	3,000	.00010	.00010	0.	.....		
4,000	4,000	.00014	.00014	0.	.....		
5,000	5,000	.00018	.00018	.00004	-.00004		
6,000	6,000	.00020	.00020	0.	.....		
7,000	7,000	.00024	.00024	0.	.....		
8,000	8,000	.00030	.00030	0.	.....		
9,000	9,000	.00038	.00038	0.	.....		
10,000	10,000	.00040	.00040	0.	.00004		
11,000	11,000	.00044	.00044	0.	.....		
12,000	12,000	.00048	.00048	0.	.....		
13,000	13,000	.00054	.00054	0.	.....		
14,000	14,000	.00060	.00060	0.	.....		
15,000	15,000	.00068	.00068	0.	.....		
16,000	16,000	.00072	.00072	0.	.....		
17,000	17,000	.00078	.00078	0.	.....		
18,000	18,000	.00080	.00080	0.	.....		
19,000	19,000	.00086	.00086	0.	.....		
20,000	20,000	.00094	.00094	0.	.....		
21,000	21,000	.00100	.00100	0.	.....		
22,000	22,000	.00106	.00106	0.	.....		
23,000	23,000	.00114	.00114	0.	.....		
24,000	24,000	.00122	.00122	0.	.....		
25,000	25,000	.00130	.00130	.00010	.00010		
26,000	26,000	.00134	.00134	0.	.....		
27,000	27,000	.00140	.00140	0.	.....		
28,000	28,000	.00150	.00150	0.	.....		
29,000	29,000	.00162	.00162	0.	.....		
30,000	30,000	.00172	.00172	.00028	.00018		
31,000	31,000	.00184	.00184	0.	.....		
32,000	32,000	.00196	.00196	0.	.....		
33,000	33,000	.00216	.00220	0.	.....		
34,000	34,000	.00236	.00220	0.	.....		
35,000	35,000	.00266	.00030	.00090	.00062		
36,000	36,000	.00296	.00030	0.	.....		
37,000	37,000	.00320	.00024	0.	.....		
38,000	38,000	.00358	.00038	0.	.....		
39,000	39,000	.00406	.00048	0.	.....		
40,000	40,000	.00440	.00034	.00234	.00144		
41,000	41,000	.00492	.00052	0.	.....		
42,000	42,000	.00544	.00052	0.	.....		
43,000	43,000	.00606	.00062	0.	.....		
44,000	44,000	.00680	.00054	0.	.....		
45,000	45,000	.00730	.00070	.00490	.00256		
46,000	46,000	.00802	.00072	0.	.....		
47,000	47,000	.00862	.00060	0.	.....		
48,000	48,000	.00932	.00070	0.	.....		
49,000	49,000	.01034	.00102	0.	.....		
50,000	50,000	.01152	.00118	.00806	.00376		
60,480	60,480	.....	.....	.....	.....		Ultimate strength.

Failed by triple flexure.

## BODY NO. 5.

No. 4531.

Marks, <sup>12 M R, T R,</sup>  
<sup>B T,</sup>  
 Diameter, 1.1129.  
 Sectional area, 1 square inch.  
 Length of stem, 23".  
 Gauged length, 20".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.000050	.000050	-----	-----	
3,000	3,000	.000100	.000050	-----	-----	
4,000	4,000	.000150	.000050	-----	-----	
5,000	5,000	.000200	.000050	.000005	.000005	
6,000	6,000	.000255	.000055	-----	-----	
7,000	7,000	.000310	.000055	-----	-----	
8,000	8,000	.000375	.000065	-----	-----	
9,000	9,000	.000435	.000060	-----	-----	
10,000	10,000	.000495	.000060	.000035	.000030	
11,000	11,000	.000550	.000055	-----	-----	
12,000	12,000	.000615	.000065	.000055	.000020	
13,000	13,000	.000685	.000070	-----	-----	
14,000	14,000	.000755	.000070	.000080	.000025	
15,000	15,000	.000825	.000070	-----	-----	
16,000	16,000	.000905	.000080	.000100	.000020	
17,000	17,000	.000980	.000085	-----	-----	
18,000	18,000	.001080	.000090	.000140	.000040	
19,000	19,000	.001190	.000110	-----	-----	
20,000	20,000	.001300	.000110	.000250	.000110	
21,000	21,000	.001460	.000160	-----	-----	
22,000	22,000	.001625	.000165	.000420	.000170	
23,000	23,000	.001855	.000230	-----	-----	
24,000	24,000	.002055	.000200	.000685	.000275	
25,000	25,000	.002400	.000345	.000940	.000245	
						Tensile strength.

Fractured 11" from neck. Appearance, granular, mottled.

No. 4532.

Marks, 12 M R, T B,

M T,

Diameter, 1".129.

Sectional area, 1 square inch.

Length of stem, 23".

Gauged length, 20".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.000050	.000050	-----	-----	
3,000	3,000	.000100	.000050	-----	-----	
4,000	4,000	.000150	.000050	-----	-----	
5,000	5,000	.000200	.000050	0.	-----	
6,000	6,000	.000250	.000050	-----	-----	
7,000	7,000	.000300	.000050	-----	-----	
8,000	8,000	.000350	.000050	-----	-----	
9,000	9,000	.000405	.000055	-----	-----	
10,000	10,000	.000460	.000055	.000010	.000010	
11,000	11,000	.000515	.000055	-----	-----	
12,000	12,000	.000575	.000060	.000030	.000020	
13,000	13,000	.000640	.000065	-----	-----	
14,000	14,000	.000700	.000060	.000045	.000015	
15,000	15,000	.000765	.000065	-----	-----	
16,000	16,000	.000825	.000060	.000055	.000010	
17,000	17,000	.000875	.000050	-----	-----	
18,000	18,000	.000935	.000060	.000060	.000005	
19,000	19,000	.001005	.000070	-----	-----	
20,000	20,000	.001085	.000080	.000080	.000020	
21,000	21,000	.001160	.000075	-----	-----	
22,000	22,000	.001270	.000110	.000120	.000040	
23,000	23,000	.001385	.000115	-----	-----	
24,000	24,000	.001495	.000110	.000210	.000090	
25,000	25,000	.001600	.000165	.000310	.000100	
27,320	27,320	-----	-----	-----	-----	

Fractured 5".7 from neck. Appearance, granular, mottled.

No. 970.

Marks, <sup>12</sup>M R, T R,  
<sub>B T</sub>  
 Length, 10<sup>1</sup>/<sub>5</sub>.  
 Diameter, 1<sup>1</sup>/<sub>129</sub>.  
 Sectional area, 1 square inch.  
 Gauged length, 5<sup>1</sup>/<sub>129</sub>.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0.	0.	0.		
2,000	2,000	.00005	.00005	.....	.....		
3,000	3,000	.00010	.00005	.....	.....		
4,000	4,000	.00014	.00004	.....	.....		
5,000	5,000	.00020	.00006	0.	.....		
6,000	6,000	.00024	.00004	.....	.....		
7,000	7,000	.00030	.00006	.....	.....		
8,000	8,000	.00034	.00004	.....	.....		
9,000	9,000	.00040	.00006	.....	.....		
10,000	10,000	.00046	.00006	.00006	.00006		
11,000	11,000	.00054	.00008	.....	.....		
12,000	12,000	.00060	.00006	.....	.....		
13,000	13,000	.00066	.00006	.....	.....		
14,000	14,000	.00074	.00008	.....	.....		
15,000	15,000	.00080	.00008	.00010	.00004		
16,000	16,000	.00086	.00006	.....	.....		
17,000	17,000	.00092	.00006	.....	.....		
18,000	18,000	.00098	.00006	.....	.....		
19,000	19,000	.00104	.00006	.....	.....		
20,000	20,000	.00110	.00006	.00016	.00006		
21,000	21,000	.00116	.00006	.....	.....		
22,000	22,000	.00122	.00006	.....	.....		
23,000	23,000	.00128	.00006	.....	.....		
24,000	24,000	.00138	.00010	.....	.....		
25,000	25,000	.00144	.00006	.00026	.00010		
26,000	26,000	.00154	.00010	.....	.....		
27,000	27,000	.00162	.00008	.....	.....		
28,000	28,000	.00170	.00008	.....	.....		
29,000	29,000	.00184	.00014	.....	.....		
30,000	30,000	.00196	.00012	.00052	.00026		
31,000	31,000	.00216	.00020	.....	.....		
32,000	32,000	.00230	.00014	.....	.....		
33,000	33,000	.00246	.00016	.....	.....		
34,000	34,000	.00270	.00024	.....	.....		
35,000	35,000	.00292	.00022	.00120	.00068		
36,000	36,000	.00332	.00040	.....	.....		
37,000	37,000	.00352	.00020	.....	.....		
38,000	38,000	.00380	.00028	.....	.....		
39,000	39,000	.00420	.00040	.....	.....		
40,000	40,000	.00464	.00044	.00264	.00144		
41,000	41,000	.00514	.00050	.....	.....		
42,000	42,000	.00546	.00032	.....	.....		
43,000	43,000	.00600	.00064	.....	.....		
44,000	44,000	.00650	.00050	.....	.....		
45,000	45,000	.00688	.00048	.00470	.00206		
46,000	46,000	.00744	.00046	.....	.....		
47,000	47,000	.00800	.00056	.....	.....		
48,000	48,000	.00842	.00042	.....	.....		
49,000	49,000	.00880	.00038	.....	.....		
50,000	50,000	.00922	.00042	.00068	.00198		
63,206	63,206	.....	.....	.....	.....		Ultimate strength.

Failed by triple flexure

H. Ex. 43—9

No. 971.

Marks <sup>12 M R, T R,</sup>  
B R<sub>10</sub>.

Length, 10''.

Diameter, 1''.129.

Sectional area, 1 square inch.

Gauged length, 5''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks. •	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0.				
2,000	2,000	.00004	.00004				
3,000	3,000	.00008	.00004				
4,000	4,000	.00014	.00006				
5,000	5,000	.00020	.00006	0.			
6,000	6,000	.00026	.00006				
7,000	7,000	.00032	.00006				
8,000	8,000	.00038	.00004				
9,000	9,000	.00040	.00004				
10,000	10,000	.00046	.00006	.00002	.00002		
11,000	11,000	.00050	.00004				
12,000	12,000	.00058	.00008				
13,000	13,000	.00066	.00008				
14,000	14,000	.00070	.00004				
15,000	15,000	.00076	.00006	.00004	.00002		
16,000	16,000	.00080	.00004				
17,000	17,000	.00084	.00004				
18,000	18,000	.00086	.00006				
19,000	19,000	.00086	.00006				
20,000	20,000	.00102	.00006	.00010	.00006		
21,000	21,000	.00110	.00008				
22,000	22,000	.00118	.00008				
23,000	23,000	.00126	.00008				
24,000	24,000	.00130	.00004				
25,000	25,000	.00140	.00010	.00020	.00010		
26,000	26,000	.00150	.00010				
27,000	27,000	.00158	.00008				
28,000	28,000	.00166	.00010				
29,000	29,000	.00180	.00012				
30,000	30,000	.00196	.00016	.00050	.00030		
31,000	31,000	.00208	.00012				
32,000	32,000	.00224	.00016				
33,000	33,000	.00246	.00022				
34,000	34,000	.00274	.00028				
35,000	35,000	.00314	.00040	.00140	.00090		
36,000	36,000	.00350	.00026				
37,000	37,000	.00382	.00032				
38,000	38,000	.00422	.00040				
39,000	39,000	.00466	.00044				
40,000	40,000	.00506	.00040	.00304	.00160		
41,000	41,000	.00556	.00050				
42,000	42,000	.00600	.00044				
43,000	43,000	.00650	.00050				
44,000	44,000	.00710	.00080				
45,000	45,000	.00760	.00050	.00530	.00226		
46,000	46,000	.00818	.00058				
47,000	47,000	.00854	.00056				
48,000	48,000	.00820	.00066				
49,000	49,000	.00890	.00070				
50,000	50,000	.01078	.00088	.00812	.00282		
62,800	62,800						Ultimate strength.

Failed by triple flexure.



No. 972.

Marks, <sup>12 M R T E,</sup>  
<sup>M T,</sup>  
 Length, 10'' 5.  
 Diameter, 1'' 129.  
 Sectional area, 1 square inch.  
 Gauged length, 5''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.00006	.00006	.....	.....	
3,000	3,000	.00010	.00010	.....	.....	
4,000	4,000	.00016	.00016	.....	.....	
5,000	5,000	.00020	.00020	0.	.....	
6,000	6,000	.00024	.00024	.....	.....	
7,000	7,000	.00030	.00030	.....	.....	
8,000	8,000	.00036	.00036	.....	.....	
9,000	9,000	.00040	.00040	.....	.....	
10,000	10,000	.00042	.00042	.00002	.00002	
11,000	11,000	.00046	.00046	.00004	.....	
12,000	12,000	.00050	.00050	.00004	.....	
13,000	13,000	.00056	.00056	.00006	.....	
14,000	14,000	.00062	.00062	.00006	.....	
15,000	15,000	.00070	.00070	.00008	.00002	
16,000	16,000	.00074	.00074	.00004	.....	
17,000	17,000	.00078	.00078	.00004	.....	
18,000	18,000	.00084	.00084	.00006	.....	
19,000	19,000	.00090	.00090	.00006	.....	
20,000	20,000	.00096	.00096	.00006	.00002	
21,000	21,000	.00100	.00100	.00004	.....	
22,000	22,000	.00106	.00106	.00006	.....	
23,000	23,000	.00110	.00110	.00004	.....	
24,000	24,000	.00116	.00116	.00006	.....	
25,000	25,000	.00124	.00124	.00008	.00004	
26,000	26,000	.00130	.00130	.00006	.....	
27,000	27,000	.00136	.00136	.00006	.....	
28,000	28,000	.00142	.00142	.00006	.....	
29,000	29,000	.00150	.00150	.00008	.....	
30,000	30,000	.00156	.00156	.00006	.00006	
31,000	31,000	.00162	.00162	.00006	.....	
32,000	32,000	.00170	.00170	.00008	.....	
33,000	33,000	.00180	.00180	.00010	.....	
34,000	34,000	.00188	.00188	.00008	.....	
35,000	35,000	.00200	.00200	.00012	.00022	
36,000	36,000	.00210	.00210	.00010	.....	
37,000	37,000	.00222	.00222	.00012	.....	
38,000	38,000	.00238	.00238	.00016	.....	
39,000	39,000	.00256	.00256	.00018	.....	
40,000	40,000	.00270	.00270	.00014	.00040	
41,000	41,000	.00296	.00296	.00022	.....	
42,000	42,000	.00322	.00322	.00026	.....	
43,000	43,000	.00352	.00352	.00030	.....	
44,000	44,000	.00388	.00388	.00036	.....	
45,000	45,000	.00424	.00424	.00036	.00126	
46,000	46,000	.00460	.00460	.00036	.....	
47,000	47,000	.00500	.00500	.00040	.....	
48,000	48,000	.00534	.00534	.00034	.....	
49,000	49,000	.00580	.00580	.00046	.....	
50,000	50,000	.00616	.00616	.00370	.00164	
65,900	65,900	.....	.....	.....	.....	

Failed by triple flexure.

## BODY No. 6.

No. 4573.

Marks, 13 M R, T R,  
 B T,  
 Diameter, 1".129.  
 Sectional area, 1 square inch.  
 Length of stem, 23".  
 Gauged length, 20".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.000050	.000050	-----	-----	
3,000	3,000	.000100	.000050	-----	-----	
4,000	4,000	.000150	.000050	-----	-----	
5,000	5,000	.000200	.000050	0.	-----	
6,000	6,000	.000200	.000060	-----	-----	
7,000	7,000	.000310	.000050	-----	-----	
8,000	8,000	.000375	.000065	-----	-----	
9,000	9,000	.000430	.000055	-----	-----	
10,000	10,000	.000500	.000070	.000015	.000015	
11,000	11,000	.000560	.000060	-----	-----	
12,000	12,000	.000635	.000075	.000045	.000030	
13,000	13,000	.000710	.000075	-----	-----	
14,000	14,000	.000785	.000075	.000085	.000040	
15,000	15,000	.000880	.000075	-----	-----	
16,000	16,000	.000950	.000090	.000110	.000025	
17,000	17,000	.001050	.000100	-----	-----	
18,000	18,000	.001155	.000105	.000190	.000080	
19,000	19,000	.001270	.000115	-----	-----	
20,000	20,000	.001405	.000135	.000300	.000110	
21,000	21,000	.001565	.000180	-----	-----	
22,000	22,000	.001760	.000175	.000505	.000205	
23,000	23,000	.001990	.000230	-----	-----	
24,000	24,000	.002240	.000250	.000835	.000330	
25,590	25,590	-----	-----	-----	-----	

Fractured 5".2 from neck. Appearance, uniform, granular.

No. 4574.

Marks, <sup>12 M R, T R,</sup>  
<sup>M T,</sup>  
 Diameter, 1".129.  
 Sectional area, 1 square inch.  
 Length of stem, 23".  
 Gauged length, 20".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.000050	.000050	.....	.....	
3,000	3,000	.000100	.000050	.....	.....	
4,000	4,000	.000150	.000050	.....	.....	
5,000	5,000	.000200	.000050	0.	.....	
6,000	6,000	.000250	.000050	.....	.....	
7,000	7,000	.000300	.000050	.....	.....	
8,000	8,000	.000350	.000050	.....	.....	
9,000	9,000	.000400	.000050	.....	.....	
10,000	10,000	.000450	.000050	.000015	.000015	
11,000	11,000	.000510	.000060	.....	.....	
12,000	12,000	.000570	.000060	.000040	.000025	
13,000	13,000	.000640	.000070	.....	.....	
14,000	14,000	.000705	.000085	.000055	.000015	
15,000	15,000	.000780	.000075	.....	.....	
16,000	16,000	.000850	.000070	.000065	.000040	
17,000	17,000	.000940	.000080	.....	.....	
18,000	18,000	.001020	.000080	.000145	.000050	
19,000	19,000	.001120	.000100	.....	.....	
20,000	20,000	.001230	.000110	.000235	.000090	
21,000	21,000	.001370	.000140	.....	.....	
22,000	22,000	.001510	.000140	.000380	.000145	
23,000	23,000	.001700	.000190	.....	.....	
24,000	24,000	.001900	.000200	.000610	.000230	
25,000	25,000	.002200	.000300	.000845	.000235	
28,390	28,390	.....	.....	.....	.....	

Fractured 2" from neck. Appearance. uniform, granular.

No. 977.

Marks, <sup>12 M R, T R,</sup>  
B T,

Length, 10''<sup>5</sup>.

Diameter, 1''<sup>.129</sup>.

Sectional area, 1 square inch.

Gauged length, 5''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0.	0.	0.		
2,000	2,000	.00004	.00004				
3,000	3,000	.00010	.00006				
4,000	4,000	.00014	.00004				
5,000	5,000	.00020	.00006	0.			
6,000	6,000	.00024	.00004				
7,000	7,000	.00030	.00006				
8,000	8,000	.00034	.00004				
9,000	9,000	.00040	.00006				
10,000	10,000	.00046	.00006	.00002	.00002		
11,000	11,000	.00050	.00004				
12,000	12,000	.00058	.00008				
13,000	13,000	.00064	.00006				
14,000	14,000	.00070	.00006				
15,000	15,000	.00076	.00006	.00006	.00004		
16,000	16,000	.00082	.00006				
17,000	17,000	.00088	.00006				
18,000	18,000	.00094	.00006				
19,000	19,000	.00102	.00008				
20,000	20,000	.00108	.00006	.00012	.00006		
21,000	21,000	.00114	.00006				
22,000	22,000	.00122	.00008				
23,000	23,000	.00128	.00006				
24,000	24,000	.00138	.00010				
25,000	25,000	.00144	.00006	.00022	.00010		
26,000	26,000	.00158	.00014				
27,000	27,000	.00168	.00010				
28,000	28,000	.00176	.00008				
29,000	29,000	.00190	.00014				
30,000	30,000	.00204	.00014	.00062	.00040		
31,000	31,000	.00222	.00018				
32,000	32,000	.00242	.00020				
33,000	33,000	.00260	.00018				
34,000	34,000	.00286	.00026				
35,000	35,000	.00322	.00036	.00152	.00080		
36,000	36,000	.00354	.00032				
37,000	37,000	.00400	.00046				
38,000	38,000	.00438	.00038				
39,000	39,000	.00480	.00042				
40,000	40,000	.00540	.00060	.00338	.00186		
41,000	41,000	.00584	.00044				
42,000	42,000	.00632	.00048				
43,000	43,000	.00678	.00046				
44,000	44,000	.00738	.00060				
45,000	45,000	.00808	.00070	.00570	.00232		
46,000	46,000	.00848	.00040				
47,000	47,000	.00910	.00062				
48,000	48,000	.00980	.00070				
49,000	49,000	.01050	.00070				
50,000	50,000	.01150	.00100	.00880	.00310		
61,200	61,200						Ultimate strength.

Failed by triple flexure.

No. 978.

Marks, <sup>12 M R, T R,</sup>  
<sub>B R,</sub>  
 Length, 10''<sup>5</sup>/<sub>16</sub>.  
 Diameter, 1''<sup>129</sup>/<sub>160</sub>.  
 Sectional area, 1 square inch.  
 Gauged length, 5''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.00006	.00006	.....	.....	
3,000	3,000	.00012	.00012	.....	.....	
4,000	4,000	.00016	.00016	.....	.....	
5,000	5,000	.00020	.00020	0.	.....	
6,000	6,000	.00024	.00024	.....	.....	
7,000	7,000	.00030	.00030	.....	.....	
8,000	8,000	.00034	.00034	.....	.....	
9,000	9,000	.00040	.00040	.....	.....	
10,000	10,000	.00044	.00044	.00002	.00002	
11,000	11,000	.00052	.00052	.....	.....	
12,000	12,000	.00058	.00058	.....	.....	
13,000	13,000	.00064	.00064	.....	.....	
14,000	14,000	.00070	.00070	.....	.....	
15,000	15,000	.00076	.00076	.00006	.00004	
16,000	16,000	.00080	.00080	.....	.....	
17,000	17,000	.00086	.00086	.....	.....	
18,000	18,000	.00092	.00092	.....	.....	
19,000	19,000	.00098	.00098	.....	.....	
20,000	20,000	.00104	.00104	.00006	0.	
21,000	21,000	.00110	.00110	.....	.....	
22,000	22,000	.00116	.00116	.....	.....	
23,000	23,000	.00124	.00124	.....	.....	
24,000	24,000	.00132	.00132	.....	.....	
25,000	25,000	.00142	.00142	.00020	.00014	
26,000	26,000	.00152	.00152	.....	.....	
27,000	27,000	.00162	.00162	.....	.....	
28,000	28,000	.00174	.00174	.....	.....	
29,000	29,000	.00186	.00186	.....	.....	
30,000	30,000	.00200	.00200	.00056	.00056	
31,000	31,000	.00218	.00218	.....	.....	
32,000	32,000	.00236	.00236	.....	.....	
33,000	33,000	.00260	.00260	.....	.....	
34,000	34,000	.00280	.00280	.....	.....	
35,000	35,000	.00320	.00320	.00150	.00094	
36,000	36,000	.00354	.00354	.....	.....	
37,000	37,000	.00384	.00384	.....	.....	
38,000	38,000	.00438	.00438	.....	.....	
39,000	39,000	.00482	.00482	.....	.....	
40,000	40,000	.00536	.00536	.00338	.00188	
41,000	41,000	.00576	.00576	.....	.....	
42,000	42,000	.00624	.00624	.....	.....	
43,000	43,000	.00670	.00670	.....	.....	
44,000	44,000	.00724	.00724	.....	.....	
45,000	45,000	.00774	.00774	.00548	.00210	
46,000	46,000	.00832	.00832	.....	.....	
47,000	47,000	.00872	.00872	.....	.....	
48,000	48,000	.00914	.00914	.....	.....	
49,000	49,000	.00944	.00944	.....	.....	
50,000	50,000	.00968	.00968	.00718	.00170	
60,200	60,200	.....	.....	.....	.....	

Failed by triple flexure.

No. 979.

Marks, <sup>12 M R, T R,</sup>  
<sub>M T,</sub>  
 Length, 10''<sup>5</sup>/<sub>8</sub>.  
 Diameter, 1''<sup>129</sup>/<sub>16</sub>.  
 Sectional area, 1 square inch.  
 Gauged length, 5''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0	0.	
2,000	2,000	.00006	.00006	.....	.....	
3,000	3,000	.00012	.00008	.....	.....	
4,000	4,000	.00018	.00008	.....	.....	
5,000	5,000	.00024	.00008	0.	.....	
6,000	6,000	.00026	.00002	.....	.....	
7,000	7,000	.00030	.00004	.....	.....	
8,000	8,000	.00036	.00006	.....	.....	
9,000	9,000	.00042	.00006	.....	.....	
10,000	10,000	.00046	.00004	0.	.....	
11,000	11,000	.00052	.00006	.....	.....	
12,000	12,000	.00058	.00006	.....	.....	
13,000	13,000	.00064	.00006	.....	.....	
14,000	14,000	.00070	.00006	.....	.....	
15,000	15,000	.00076	.00006	.00004	.00004	
16,000	16,000	.00080	.00004	.....	.....	
17,000	17,000	.00086	.00006	.....	.....	
18,000	18,000	.00094	.00008	.....	.....	
19,000	19,000	.00100	.00006	.....	.....	
20,000	20,000	.00108	.00008	.00008	.00004	
21,000	21,000	.00114	.00008	.....	.....	
22,000	22,000	.00122	.00008	.....	.....	
23,000	23,000	.00130	.00008	.....	.....	
24,000	24,000	.00136	.00006	.....	.....	
25,000	25,000	.00146	.00010	.00020	.00012	
26,000	26,000	.00156	.00010	.....	.....	
27,000	27,000	.00166	.00010	.....	.....	
28,000	28,000	.00176	.00010	.....	.....	
29,000	29,000	.00194	.00018	.....	.....	
30,000	30,000	.00216	.00022	.00042	.00042	
31,000	31,000	.00236	.00020	.....	.....	
32,000	32,000	.00256	.00020	.....	.....	
33,000	33,000	.00276	.00022	.....	.....	
34,000	34,000	.00302	.00024	.....	.....	
35,000	35,000	.00350	.00048	.00170	.00108	
36,000	36,000	.00390	.00030	.....	.....	
37,000	37,000	.00414	.00034	.....	.....	
38,000	38,000	.00454	.00040	.....	.....	
39,000	39,000	.00488	.00034	.....	.....	
40,000	40,000	.00560	.00072	.00360	.00190	
41,000	41,000	.00634	.00074	.....	.....	
42,000	42,000	.00674	.00040	.....	.....	
43,000	43,000	.00722	.00048	.....	.....	
44,000	44,000	.00784	.00062	.....	.....	
45,000	45,000	.00840	.00056	.00620	.00260	
46,000	46,000	.00920	.00080	.....	.....	
47,000	47,000	.00990	.00070	.....	.....	
48,000	48,000	.01064	.00074	.....	.....	
49,000	49,000	.01166	.00102	.....	.....	
50,000	50,000	.01280	.00114	.01000	.00380	
50,800	50,800	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

BODY No. 7.

No. 4575.

Marks, <sup>12 M R, T R,</sup>  
<sub>B T,</sub>  
 Diameter, 1".129.  
 Sectional area, 1 square inch.  
 Length of stem, 23".  
 Gauged length, 20".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.000040	.000040	-----	-----	
3,000	3,000	.000080	.000050	-----	-----	
4,000	4,000	.000140	.000050	-----	-----	
5,000	5,000	.000180	.000050	0.	-----	
6,000	6,000	.000240	.000050	-----	-----	
7,000	7,000	.000290	.000050	-----	-----	
8,000	8,000	.000345	.000055	-----	-----	
9,000	9,000	.000400	.000055	-----	-----	
10,000	10,000	.000455	.000055	.000015	.000015	
11,000	11,000	.000515	.000060	-----	-----	
12,000	12,000	.000570	.000055	.000035	.000020	
13,000	13,000	.000640	.000070	-----	-----	
14,000	14,000	.000705	.000065	.000055	.000020	
15,000	15,000	.000780	.000075	-----	-----	
16,000	16,000	.000850	.000070	.000085	.000030	
17,000	17,000	.000980	.000080	-----	-----	
18,000	18,000	.001005	.000075	.000140	.000055	
19,000	19,000	.001100	.000095	-----	-----	
20,000	20,000	.001200	.000100	.000205	.000065	
21,000	21,000	.001325	.000125	-----	-----	
22,000	22,000	.001440	.000115	.000320	.000115	
23,000	23,000	.001510	.000170	-----	-----	
24,000	24,000	.001775	.000165	.000515	.000195	
25,000	25,000	.002000	.000225	.000670	.000155	
30,500	30,500	-----	-----	-----	-----	Tensile strength.

Fractured 4".2 from neck. Appearance, medium fine granular.

No. 4576.

Marks, <sup>12 M R, T R,</sup>  
<sup>M T,</sup>  
 Diameter, 1".129.  
 Sectional area, 1 square inch.  
 Length of stem, 23".  
 Gauged length, 20".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.000040	.000040	.....	.....	
3,000	3,000	.000085	.000045	.....	.....	
4,000	4,000	.000125	.000050	.....	.....	
5,000	5,000	.000180	.000045	0.	.....	
6,000	6,000	.000235	.000055	.....	.....	
7,000	7,000	.000285	.000050	.....	.....	
8,000	8,000	.000335	.000050	.....	.....	
9,000	9,000	.000385	.000050	.....	.....	
10,000	10,000	.000445	.000060	.000005	.000005	
11,000	11,000	.000500	.000055	.....	.....	
12,000	12,000	.000560	.000060	.000030	.000025	
13,000	13,000	.000630	.000070	.....	.....	
14,000	14,000	.000695	.000065	.000055	.000025	
15,000	15,000	.000760	.000065	.....	.....	
16,000	16,000	.000845	.000085	.000100	.000045	
17,000	17,000	.000915	.000070	.....	.....	
18,000	18,000	.001010	.000095	.000150	.000050	
19,000	19,000	.001105	.000095	.....	.....	
20,000	20,000	.001230	.000125	.000250	.000100	
21,000	21,000	.001360	.000130	.....	.....	
22,000	22,000	.001510	.000150	.000400	.000150	
23,000	23,000	.001745	.000235	.....	.....	
24,000	24,000	.001950	.000265	.000700	.000300	
25,000	25,000	.002290	.000340	.000955	.000255	
27,640	27,640	.....	.....	.....	.....	

Fractured 1" from neck. Appearance, granular, mottled.



No. 980.

Marks, 12 M R, T E,  
 B T,  
 Length, 10".5.  
 Diameter, 1".129.  
 Sectional area, 1 square inch.  
 Gauged length, 5".

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0.	0.	0.		
2,000	2,000	.00004	.00004				
3,000	3,000	.00008	.00004				
4,000	4,000	.00012	.00004				
5,000	5,000	.00016	.00004	0.			
6,000	6,000	.00020	.00004				
7,000	7,000	.00026	.00006				
8,000	8,000	.00032	.00006				
9,000	9,000	.00038	.00006				
10,000	10,000	.00042	.00004	0.			
11,000	11,000	.00048	.00006				
12,000	12,000	.00052	.00004				
13,000	13,000	.00058	.00006				
14,000	14,000	.00064	.00006				
15,000	15,000	.00068	.00004	.00004	.00004		
16,000	16,000	.00076	.00008				
17,000	17,000	.00080	.00004				
18,000	18,000	.00086	.00006				
19,000	19,000	.00092	.00006				
20,000	20,000	.00098	.00008	.00006	.00002		
21,000	21,000	.00106	.00008				
22,000	22,000	.00112	.00006				
23,000	23,000	.00120	.00008				
24,000	24,000	.00128	.00008				
25,000	25,000	.00134	.00006	.00020	.00014		
26,000	26,000	.00146	.00012				
27,000	27,000	.00156	.00010				
28,000	28,000	.00166	.00010				
29,000	29,000	.00178	.00012				
30,000	30,000	.00192	.00014	.00050	.00030		
31,000	31,000	.00204	.00012				
32,000	32,000	.00222	.00018				
33,000	33,000	.00246	.00024				
34,000	34,000	.00268	.00022				
35,000	35,000	.00294	.00026	.00130	.00080		
36,000	36,000	.00334	.00040				
37,000	37,000	.00362	.00028				
38,000	38,000	.00396	.00034				
39,000	39,000	.00440	.00044				
40,000	40,000	.00490	.00050	.00290	.00160		
41,000	41,000	.00542	.00052				
42,000	42,000	.00588	.00046				
43,000	43,000	.00640	.00052				
44,000	44,000	.00690	.00050				
45,000	45,000	.00760	.00070	.00538	.00248		
46,000	46,000	.00820	.00060				
47,000	47,000	.00868	.00048				
48,000	48,000	.00926	.00058				
49,000	49,000	.00994	.00068				
50,000	50,000	.01070	.00076	.00820	.00282		
61,800	61,800						Ultimate strength.

Failed by triple flexure.

No. 981.

Marks, 12 M R, T R,  
 B B,<sup>10</sup>  
 Length, 10'' .5.  
 Diameter, 1'' .129.  
 Sectional area, 1 square inch.  
 Gauged length, 5''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total	Per square inch.					
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.00006	.00006			
3,000	3,000	.00012	.00006			
4,000	4,000	.00018	.00006			
5,000	5,000	.00022	.00004	0.		
6,000	6,000	.00026	.00004			
7,000	7,000	.00030	.00004			
8,000	8,000	.00034	.00004			
9,000	9,000	.00040	.00006			
10,000	10,000	.00046	.00006	.00001	.00001	
11,000	11,000	.00050	.00004			
12,000	12,000	.00054	.00004			
13,000	13,000	.00060	.00006			
14,000	14,000	.00066	.00006			
15,000	15,000	.00070	.00004	.00006	.00005	
16,000	16,000	.00076	.00006			
17,000	17,000	.00084	.00008			
18,000	18,000	.00090	.00006			
19,000	19,000	.00096	.00006			
20,000	20,000	.00100	.00004	.00010	.00004	
21,000	21,000	.00106	.00006			
22,000	22,000	.00114	.00008			
23,000	23,000	.00120	.00006			
24,000	24,000	.00128	.00008			
25,000	25,000	.00136	.00008	.00020	.00010	
26,000	26,000	.00146	.00010			
27,000	27,000	.00152	.00006			
28,000	28,000	.00162	.00010			
29,000	29,000	.00174	.00012			
30,000	30,000	.00190	.00016	.00050	.00030	
31,000	31,000	.00202	.00012			
32,000	32,000	.00222	.00020			
33,000	33,000	.00244	.00022			
34,000	34,000	.00270	.00028			
35,000	35,000	.00296	.00028	.00120	.00080	
36,000	36,000	.00336	.00040			
37,000	37,000	.00366	.00030			
38,000	38,000	.00402	.00036			
39,000	39,000	.00454	.00052			
40,000	40,000	.00512	.00058	.00316	.00186	
41,000	41,000	.00548	.00036			
42,000	42,000	.00598	.00050			
43,000	43,000	.00660	.00062			
44,000	44,000	.00716	.00056			
45,000	45,000	.00784	.00068	.00562	.00246	
46,000	46,000	.00836	.00052			
47,000	47,000	.00880	.00024			
48,000	48,000	.00910	.00050			
49,000	49,000	.00978	.00068			
50,000	50,000	.01046	.00068	.00800	.00238	
60,580	60,580					Ultimate strength.

Failed by triple flexure.

No. 982.

Marks, <sup>12 M R T R,</sup>  
<sup>M T,</sup>  
 Length, 10' 5".  
 Diameter, 1" .129.  
 Sectional area, 1 square inch.  
 Gauged length, 5'.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0.	0.	0.		
2,000	2,000	.00006	.00006	.....	.....		
3,000	3,000	.00012	.00006	.....	.....		
4,000	4,000	.00018	.00004	.....	.....		
5,000	5,000	.00022	.00006	0	.....		
6,000	6,000	.00028	.00004	.....	.....		
7,000	7,000	.00030	.00004	.....	.....		
8,000	8,000	.00036	.00006	.....	.....		
9,000	9,000	.00042	.00006	.....	.....		
10,000	10,000	.00048	.00006	.00002	.00002		
11,000	11,000	.00052	.00004	.....	.....		
12,000	12,000	.00058	.00006	.....	.....		
13,000	13,000	.00064	.00006	.....	.....		
14,000	14,000	.00070	.00006	.....	.....		
15,000	15,000	.00078	.00008	.00004	.00002		
16,000	16,000	.00082	.00004	.....	.....		
17,000	17,000	.00090	.00008	.....	.....		
18,000	18,000	.00096	.00006	.....	.....		
19,000	19,000	.00104	.00008	.....	.....		
20,000	20,000	.00110	.00006	.00014	.00010		
21,000	21,000	.00116	.00006	.....	.....		
22,000	22,000	.00124	.00008	.....	.....		
23,000	23,000	.00132	.00008	.....	.....		
24,000	24,000	.00140	.00008	.....	.....		
25,000	25,000	.00150	.00010	.00030	.00016		
26,000	26,000	.00162	.00012	.....	.....		
27,000	27,000	.00172	.00010	.....	.....		
28,000	28,000	.00190	.00018	.....	.....		
29,000	29,000	.00202	.00012	.....	.....		
30,000	30,000	.00224	.00022	.00076	.00046		
31,000	31,000	.00246	.00022	.....	.....		
32,000	32,000	.00268	.00022	.....	.....		
33,000	33,000	.00296	.00028	.....	.....		
34,000	34,000	.00330	.00034	.....	.....		
35,000	35,000	.00368	.00038	.00196	.00120		
36,000	36,000	.00420	.00052	.....	.....		
37,000	37,000	.00456	.00038	.....	.....		
38,000	38,000	.00500	.00044	.....	.....		
39,000	39,000	.00550	.00050	.....	.....		
40,000	40,000	.00608	.00058	.00414	.00218		
41,000	41,000	.00680	.00072	.....	.....		
42,000	42,000	.00728	.00046	.....	.....		
43,000	43,000	.00790	.00064	.....	.....		
44,000	44,000	.00860	.00070	.....	.....		
45,000	45,000	.00918	.00058	.00634	.00270		
46,000	46,000	.01018	.00100	.....	.....		
47,000	47,000	.01096	.00078	.....	.....		
48,000	48,000	.01196	.00100	.....	.....		
49,000	49,000	.01320	.00124	.....	.....		
50,000	50,000	.01420	.00100	.01138	.00454		
55,910	55,910	.....	.....	.....	.....		Ultimate strength.

Failed by triple flexure.

## BODY NO. 8.

No. 4578.

Marks, <sup>13 M R<sub>2</sub> T R<sub>2</sub></sup>  
<sub>B T<sub>1</sub></sub>Diameter, 1<sup>1</sup>/<sub>2</sub>".129.

Sectional area, 1 square inch.

Length of stem, 23<sup>1</sup>/<sub>2</sub>".Gauged length, 20<sup>1</sup>/<sub>2</sub>".

Applied load.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.000050	.000050	.....	.....	
3,000	3,000	.000100	.000050	.....	.....	
4,000	4,000	.000150	.000050	.....	.....	
5,000	5,000	.000205	.000055	0.	.....	
6,000	6,000	.000260	.000055	.....	.....	
7,000	7,000	.000315	.000055	.....	.....	
8,000	8,000	.000380	.000065	.....	.....	
9,000	9,000	.000440	.000080	.....	.....	
10,000	10,000	.000500	.000090	.000030	.000030	
11,000	11,000	.000570	.000070	.....	.....	
12,000	12,000	.000645	.000075	.000045	.000015	
13,000	13,000	.000710	.000065	.....	.....	
14,000	14,000	.000795	.000085	.000080	.000035	
15,000	15,000	.000885	.000090	.....	.....	
16,000	16,000	.000980	.000075	.000115	.000035	
17,000	17,000	.001070	.000110	.....	.....	
18,000	18,000	.001170	.000100	.000190	.000075	
19,000	19,000	.001300	.000130	.....	.....	
20,000	20,000	.001440	.000140	.000310	.000120	
21,000	21,000	.001590	.000150	.....	.....	
22,000	22,000	.001775	.000185	.000510	.000200	
23,000	23,000	.001975	.000200	.....	.....	
24,000	24,000	.002290	.000315	.000850	.000340	
28,040	28,040	.....	.....	.....	.....	Tensile strength.

Fractured 5<sup>1</sup>/<sub>2</sub>" from neck. Appearance, uniform, granular.

No. 4579.

Marks, <sup>12 M R, T B,</sup>  
<sup>M T<sub>1</sub></sup>  
 Diameter, 1".129.  
 Sectional area, 1 square inch.  
 Length of stem, 23".  
 Gauged length, 20".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.000050	.000050	.....	.....	
3,000	3,000	.000100	.000050	.....	.....	
4,000	4,000	.000150	.000050	.....	.....	
5,000	5,000	.000200	.000050	0.	.....	
6,000	6,000	.000255	.000055	.....	.....	
7,000	7,000	.000305	.000050	.....	.....	
8,000	8,000	.000355	.000050	.....	.....	
9,000	9,000	.000410	.000055	.....	.....	
10,000	10,000	.000470	.000060	.000020	.000020	
11,000	11,000	.000540	.000070	.....	.....	
12,000	12,000	.000605	.000085	.000040	.000040	
13,000	13,000	.000685	.000090	.....	.....	
14,000	14,000	.000750	.000095	.000060	.000020	
15,000	15,000	.000825	.000075	.....	.....	
16,000	16,000	.000905	.000080	.000105	.000045	
17,000	17,000	.001005	.000100	.....	.....	
18,000	18,000	.001100	.000095	.000185	.000080	
19,000	19,000	.001215	.000115	.....	.....	
20,000	20,000	.001345	.000130	.000285	.000100	
21,000	21,000	.001510	.000165	.....	.....	
22,000	22,000	.001700	.000190	.000495	.000210	
23,000	23,000	.001960	.000260	.....	.....	
24,000	24,000	.002210	.000250	.000855	.000380	
25,000	25,000	.002565	.000355	.001130	.000275	
25,000	25,000	.....	.....	.....	.....	Tensile strength.

Fractured  $\frac{1}{2}$ " from middle. Appearance, uniform, granular.

No. 983.

Marks, <sup>12</sup> M R, <sup>T R,</sup>  
<sub>B T,</sub>  
 Length, 10'' .5.  
 Diameter, 1'' .129.  
 Sectional area, 1 square inch.  
 Gauged length, 5''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.00006	.00006			
3,000	3,000	.00016	.00010			
4,000	4,000	.00020	.00004			
5,000	5,000	.00028	.00006	.00006	.00006	
6,000	6,000	.00030	.00004			
7,000	7,000	.00038	.00006			
8,000	8,000	.00042	.00004			
9,000	9,000	.00048	.00006			
10,000	10,000	.00052	.00004	.00008	.00002	
11,000	11,000	.00056	.00004			
12,000	12,000	.00062	.00006			
13,000	13,000	.00068	.00006			
14,000	14,000	.00078	.00008			
15,000	15,000	.00082	.00006	.00010	.00002	
16,000	16,000	.00086	.00004			
17,000	17,000	.00094	.00008			
18,000	18,000	.00100	.00006			
19,000	19,000	.00106	.00006			
20,000	20,000	.00114	.00008	.00018	.00008	
21,000	21,000	.00120	.00006			
22,000	22,000	.00128	.00006			
23,000	23,000	.00134	.00008			
24,000	24,000	.00142	.00006			
25,000	25,000	.00154	.00012	.00030	.00012	
26,000	26,000	.00164	.00010			
27,000	27,000	.00170	.00006			
28,000	28,000	.00182	.00012			
29,000	29,000	.00196	.00014			
30,000	30,000	.00212	.00016	.00070	.00040	
31,000	31,000	.00230	.00018			
32,000	32,000	.00250	.00020			
33,000	33,000	.00270	.00020			
34,000	34,000	.00300	.00030			
35,000	35,000	.00336	.00036	.00158	.00038	
36,000	36,000	.00374	.00038			
37,000	37,000	.00396	.00024			
38,000	38,000	.00444	.00046			
39,000	39,000	.00480	.00036			
40,000	40,000	.00506	.00026	.00320	.00162	
41,000	41,000	.00544	.00038			
42,000	42,000	.00574	.00030			
43,000	43,000	.00640	.00066			
44,000	44,000	.00684	.00044			
45,000	45,000	.00728	.00044	.00514	.00194	
46,000	46,000	.00786	.00058			
47,000	47,000	.00816	.00030			
48,000	48,000	.00840	.00024			
49,000	49,000	.00854	.00014			
50,000	50,000	.00858	.00004	.00622	.00108	
58,680	58,680					Ultimate strength.

Failed by triple flexure.

No. 984.

Marks, <sup>12 M R<sub>2</sub> T R<sub>2</sub></sup>  
<sup>B R<sub>10</sub></sup>  
 Length, 10' 5".  
 Diameter, 1' 12.9".  
 Sectional area, 1 square inch.  
 Gauged length, 5'.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0.	0.	0.		
2,000	2,000	.00006	.00006				
3,000	3,000	.00012	.00006				
4,000	4,000	.00018	.00006				
5,000	5,000	.00022	.00004	0.			
6,000	6,000	.00026	.00004				
7,000	7,000	.00030	.00004				
8,000	8,000	.00036	.00006				
9,000	9,000	.00042	.00006				
10,000	10,000	.00046	.00004	0.			
11,000	11,000	.00052	.00006				
12,000	12,000	.00060	.00008				
13,000	13,000	.00066	.00006				
14,000	14,000	.00070	.00004				
15,000	15,000	.00076	.00006	.00006	.00006		
16,000	16,000	.00080	.00004				
17,000	17,000	.00086	.00006				
18,000	18,000	.00092	.00006				
19,000	19,000	.00098	.00006				
20,000	20,000	.00104	.00006	.00012	.00006		
21,000	21,000	.00110	.00006				
22,000	22,000	.00118	.00008				
23,000	23,000	.00126	.00008				
24,000	24,000	.00134	.00008				
25,000	25,000	.00140	.00006	.00024	.00012		
26,000	26,000	.00150	.00010				
27,000	27,000	.00158	.00008				
28,000	28,000	.00170	.00012				
29,000	29,000	.00186	.00016				
30,000	30,000	.00208	.00022	.00066	.00042		
31,000	31,000	.00232	.00024				
32,000	32,000	.00244	.00012				
33,000	33,000	.00266	.00022				
34,000	34,000	.00294	.00028				
35,000	35,000	.00340	.00046	.00176	.00110		
36,000	36,000	.00378	.00038				
37,000	37,000	.00412	.00034				
38,000	38,000	.00446	.00034				
39,000	39,000	.00478	.00030				
40,000	40,000	.00538	.00062	.00374	.00198		
41,000	41,000	.00508	.00060				
42,000	42,000	.00634	.00036				
43,000	43,000	.00710	.00076				
44,000	44,000	.00754	.00044				
45,000	45,000	.00810	.00056	.00612	.00236		
46,000	46,000	.00880	.00070				
47,000	47,000	.00958	.00078				
48,000	48,000	.00996	.00038				
49,000	49,000	.01084	.00088				
50,000	50,000	.01200	.00116	.00936	.00524		
58,750	58,750						Ultimate strength.

Failed by triple flexure.

H. Ex. 43—10

No. 985.

Marks, <sup>12 M R, T R,</sup>  
<sub>M T,</sub>  
 Length, 10<sup>1</sup>/<sub>5</sub>.  
 Diameter, 1<sup>1</sup>/<sub>129</sub>.  
 Sectional area, 1 square inch.  
 Gauged length, 5<sup>1</sup>/<sub>2</sub>.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0	0.	0.		
2,000	2,000	.00006	.00006	.....	.....		
3,000	3,000	.00012	.00006	.....	.....		
4,000	4,000	.00016	.00004	.....	.....		
5,000	5,000	.00020	.00004	0.	.....		
6,000	6,000	.00024	.00004	.....	.....		
7,000	7,000	.00030	.00006	.....	.....		
8,000	8,000	.00036	.00006	.....	.....		
9,000	9,000	.00040	.00004	.....	.....		
10,000	10,000	.00046	.00006	.00004	.00004		
11,000	11,000	.00050	.00004	.....	.....		
12,000	12,000	.00056	.00006	.....	.....		
13,000	13,000	.00060	.00004	.....	.....		
14,000	14,000	.00064	.00004	.....	.....		
15,000	15,000	.00072	.00008	.00006	.00002		
16,000	16,000	.00076	.00004	.....	.....		
17,000	17,000	.00084	.00008	.....	.....		
18,000	18,000	.00090	.00006	.....	.....		
19,000	19,000	.00096	.00006	.....	.....		
20,000	20,000	.00102	.00006	.00012	.00006		
21,000	21,000	.00106	.00004	.....	.....		
22,000	22,000	.00112	.00006	.....	.....		
23,000	23,000	.00120	.00008	.....	.....		
24,000	24,000	.00128	.00008	.....	.....		
25,000	25,000	.00136	.00008	.00022	.00010		
26,000	26,000	.00142	.00006	.....	.....		
27,000	27,000	.00150	.00008	.....	.....		
28,000	28,000	.00160	.00010	.....	.....		
29,000	29,000	.00172	.00012	.....	.....		
30,000	30,000	.00184	.00012	.00046	.00024		
31,000	31,000	.00204	.00020	.....	.....		
32,000	32,000	.00214	.00010	.....	.....		
33,000	33,000	.00230	.00016	.....	.....		
34,000	34,000	.00250	.00020	.....	.....		
35,000	35,000	.00280	.00030	.00114	.00068		
36,000	36,000	.03310	.00030	.....	.....		
37,000	37,000	.00344	.00034	.....	.....		
38,000	38,000	.00380	.00036	.....	.....		
39,000	39,000	.00436	.00056	.....	.....		
40,000	40,000	.00480	.00044	.00292	.00178		
41,000	41,000	.00520	.00040	.....	.....		
42,000	42,000	.00570	.00050	.....	.....		
43,000	43,000	.00598	.00028	.....	.....		
44,000	44,000	.00650	.00052	.....	.....		
45,000	45,000	.00696	.00046	.00486	.00194		
46,000	46,000	.00732	.00036	.....	.....		
47,000	47,000	.00770	.00038	.....	.....		
48,000	48,000	.00806	.00036	.....	.....		
49,000	49,000	.00848	.00042	.....	.....		
50,000	50,000	.00876	.00028	.00664	.00178		
58,020	58,020	.....	.....	.....	.....		Ultimate strength.

Failed by triple flexure.



## BODY No. 9.

No. 4580.

Marks, <sup>12 M R, T R,</sup>  
<sub>B T,</sub>  
 Diameter, 1<sup>1</sup>/<sub>16</sub> .129.  
 Sectional area, 1 square inch.  
 Length of stem, 23<sup>1</sup>/<sub>2</sub> .  
 Gauged length, 20<sup>1</sup>/<sub>2</sub> .

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.000050	.000050			
3,000	3,000	.000100	.000050			
4,000	4,000	.000155	.000055			
5,000	5,000	.000205	.000050	.000005	.000005	
6,000	6,000	.000260	.000055			
7,000	7,000	.000320	.000060			
8,000	8,000	.000380	.000060			
9,000	9,000	.000445	.000065			
10,000	10,000	.000510	.000065	.000015	.000010	
11,000	11,000	.000570	.000060			
12,000	12,000	.000640	.000070	.000035	.000020	
13,000	13,000	.000710	.000070			
14,000	14,000	.000790	.000080	.000060	.000025	
15,000	15,000	.000880	.000090			
16,000	16,000	.000965	.000085	.000105	.000045	
17,000	17,000	.001065	.000100			
18,000	18,000	.001190	.000125	.000100	.000085	
19,000	19,000	.001310	.000120			
20,000	20,000	.001455	.000145	.000315	.000125	
21,000	21,000	.001645	.000190			
22,000	22,000	.001850	.000205	.000550	.000235	
23,000	23,000	.002100	.000250			
24,000	24,000	.002375	.000275	.000020	.000370	
28,030	28,030					Tensile strength.

Fractured 9" from neck. Appearance, uniform, granular.

No. 4581.

Marks, 12 M R, T B,  
<sup>M T</sup>  
 Diameter, 1".129.  
 Sectional area, 1 square inch.  
 Length of stem, 23 1/2".  
 Gauged length, 20".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.000050	.000050			
3,000	3,000	.000100	.000050			
4,000	4,000	.000150	.000050			
5,000	5,000	.000200	.000050	0.		
6,000	6,000	.000255	.000055			
7,000	7,000	.000305	.000050			
8,000	8,000	.000360	.000055			
9,000	9,000	.000415	.000055			
10,000	10,000	.000480	.000065	.000010	.000010	
11,000	11,000	.000540	.000060			
12,000	12,000	.000605	.000065	.000030	.000020	
13,000	13,000	.000670	.000065			
14,000	14,000	.000735	.000065	.000050	.000020	
15,000	15,000	.000810	.000075			
16,000	16,000	.000885	.000085	.000085	.000035	
17,000	17,000	.000985	.000090			
18,000	18,000	.001075	.000090	.000140	.000035	
19,000	19,000	.001180	.000105			
20,000	20,000	.001290	.000110	.000235	.000085	
21,000	21,000	.001435	.000145			
22,000	22,000	.001590	.000155	.000390	.000155	
23,000	23,000	.001775	.000185			
24,000	24,000	.001985	.000210	.000840	.000250	
25,000	25,000	.002275	.000290	.000845	.000205	
26,980	26,980					

Fractured 11" from neck. Appearance, uniform, granular.

No. 986.

Marks, <sup>12 M R, T R,</sup>  
B T,

Length, 10'.5.

Diameter, 1".129.

Sectional area, 1 square inch.

Gauged length, 5'.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.00006	.00006			
3,000	3,000	.00016	.00010			
4,000	4,000	.00022	.00006			
5,000	5,000	.00028	.00004	.00006	.00006	
6,000	6,000	.00032	.00006			
7,000	7,000	.00038	.00006			
8,000	8,000	.00044	.00006			
9,000	9,000	.00050	.00006			
10,000	10,000	.00056	.00006	.00010	.00004	
11,000	11,000	.00062	.00006			
12,000	12,000	.00068	.00004			
13,000	13,000	.00072	.00006			
14,000	14,000	.00080	.00008			
15,000	15,000	.00088	.00008	.00016	.00006	
16,000	16,000	.00094	.00006			
17,000	17,000	.00100	.00006			
18,000	18,000	.00106	.00006			
19,000	19,000	.00108	.00002			
20,000	20,000	.00120	.00012	.00022	.00006	
21,000	21,000	.00130	.00010			
22,000	22,000	.00138	.00008			
23,000	23,000	.00146	.00008			
24,000	24,000	.00154	.00008			
25,000	25,000	.00184	.00010	.00040	.00018	
26,000	26,000	.00174	.00010			
27,000	27,000	.00186	.00012			
28,000	28,000	.00198	.00012			
29,000	29,000	.00212	.00014			
30,000	30,000	.00228	.00016	.00074	.00034	
31,000	31,000	.00250	.00022			
32,000	32,000	.00266	.00016			
33,000	33,000	.00288	.00022			
34,000	34,000	.00320	.00032			
35,000	35,000	.00352	.00032	.00170	.00096	
36,000	36,000	.00390	.00038			
37,000	37,000	.00418	.00028			
38,000	38,000	.00456	.00038			
39,000	39,000	.00502	.00046			
40,000	40,000	.00538	.00036	.00346	.00176	
41,000	41,000	.00600	.00062			
42,000	42,000	.00650	.00050			
43,000	43,000	.00700	.00050			
44,000	44,000	.00756	.00056			
45,000	45,000	.00796	.00040	.00502	.00216	
46,000	46,000	.00858	.00062			
47,000	47,000	.00918	.00060			
48,000	48,000	.00972	.00054			
49,000	49,000	.01022	.00050			
50,000	50,000	.01088	.00066	.00816	.00254	
50,500	50,500					Ultimate strength.

Failed by triple flexure.

No. 987.

Marks, <sup>12 M R, T R,</sup>  
<sub>B R,</sub>  
 Length, 10''<sup>5</sup>  
 Diameter, 1''<sup>.129</sup>  
 Sectional area, 1 square inch.  
 Gauged length, 5''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.00004	.00004	.....	.....	
3,000	3,000	.00010	.00006	.....	.....	
4,000	4,000	.00014	.00004	.....	.....	
5,000	5,000	.00018	.00004	0.	.....	
6,000	6,000	.00024	.00006	.....	.....	
7,000	7,000	.00028	.00004	.....	.....	
8,000	8,000	.00034	.00006	.....	.....	
9,000	9,000	.00040	.00006	.....	.....	
10,000	10,000	.00044	.00004	0.	.....	
11,000	11,000	.00050	.00006	.....	.....	
12,000	12,000	.00056	.00009	.....	.....	
13,000	13,000	.00060	.00004	.....	.....	
14,000	14,000	.00066	.00006	.....	.....	
15,000	15,000	.00072	.00006	.00004	.00004	
16,000	16,000	.00078	.00006	.....	.....	
17,000	17,000	.00084	.00006	.....	.....	
18,000	18,000	.00090	.00006	.....	.....	
19,000	19,000	.00096	.00006	.....	.....	
20,000	20,000	.00104	.00008	.00010	.00006	
21,000	21,000	.00110	.00006	.....	.....	
22,000	22,000	.00116	.00006	.....	.....	
23,000	23,000	.00124	.00008	.....	.....	
24,000	24,000	.00134	.00010	.....	.....	
25,000	25,000	.00142	.00008	.00022	.00012	
26,000	26,000	.00150	.00008	.....	.....	
27,000	27,000	.00160	.00010	.....	.....	
28,000	28,000	.00172	.00012	.....	.....	
29,000	29,000	.00186	.00014	.....	.....	
30,000	30,000	.00200	.00014	.00056	.00034	
31,000	31,000	.00220	.00020	.....	.....	
32,000	32,000	.00238	.00018	.....	.....	
33,000	33,000	.00254	.00016	.....	.....	
34,000	34,000	.00284	.00030	.....	.....	
35,000	35,000	.00320	.00036	.00148	.00092	
36,000	36,000	.00350	.00030	.....	.....	
37,000	37,000	.00378	.00028	.....	.....	
38,000	38,000	.00426	.00048	.....	.....	
39,000	39,000	.00482	.00056	.....	.....	
40,000	40,000	.00520	.00038	.00320	.00172	
41,000	41,000	.00576	.00056	.....	.....	
42,000	42,000	.00618	.00042	.....	.....	
43,000	43,000	.00660	.00042	.....	.....	
44,000	44,000	.00718	.00058	.....	.....	
45,000	45,000	.00768	.00050	.00542	.00222	
46,000	46,000	.00816	.00048	.....	.....	
47,000	47,000	.00864	.00048	.....	.....	
48,000	48,000	.00914	.00050	.....	.....	
49,000	49,000	.00950	.00036	.....	.....	
50,000	50,000	.00976	.00028	.00720	.00178	
50,650	50,650	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

No. 988.

Marks, <sup>12 M R<sub>2</sub> T R<sub>1</sub></sup>  
<sub>M T<sub>3</sub></sub>  
 Length, 10'' .5.  
 Diameter, 1'' .129.  
 Sectional area, 1 square inch.  
 Gauged length, 5''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0.	0.	0.		
2,000	2,000	.00004	.00004	.....	.....		
3,000	3,000	.00010	.00006	.....	.....		
4,000	4,000	.00016	.00006	.....	.....		
5,000	5,000	.00022	.00006	0.	.....		
6,000	6,000	.00028	.00006	.....	.....		
7,000	7,000	.00032	.00004	.....	.....		
8,000	8,000	.00038	.00006	.....	.....		
9,000	9,000	.00044	.00006	.....	.....		
10,000	10,000	.00048	.00004	0.	.....		
11,000	11,000	.00054	.00006	.....	.....		
12,000	12,000	.00058	.00004	.....	.....		
13,000	13,000	.00064	.00006	.....	.....		
14,000	14,000	.00070	.00006	.....	.....		
15,000	15,000	.00076	.00006	.00002	.00002		
16,000	16,000	.00082	.00006	.....	.....		
17,000	17,000	.00088	.00006	.....	.....		
18,000	18,000	.00094	.00006	.....	.....		
19,000	19,000	.00100	.00006	.....	.....		
20,000	20,000	.00106	.00006	.00012	.00010		
21,000	21,000	.00114	.00008	.....	.....		
22,000	22,000	.00122	.00008	.....	.....		
23,000	23,000	.00128	.00006	.....	.....		
24,000	24,000	.00136	.00008	.....	.....		
25,000	25,000	.00144	.00008	.00024	.00012		
26,000	26,000	.00152	.00008	.....	.....		
27,000	27,000	.00158	.00006	.....	.....		
28,000	28,000	.00166	.00008	.....	.....		
29,000	29,000	.00180	.00014	.....	.....		
30,000	30,000	.00188	.00018	.00046	.00022		
31,000	31,000	.00206	.00008	.....	.....		
32,000	32,000	.00222	.00016	.....	.....		
33,000	33,000	.00244	.00022	.....	.....		
34,000	34,000	.00264	.00020	.....	.....		
35,000	35,000	.00294	.00030	.00118	.00072		
36,000	36,000	.00324	.00030	.....	.....		
37,000	37,000	.00354	.00030	.....	.....		
38,000	38,000	.00396	.00044	.....	.....		
39,000	39,000	.00450	.00052	.....	.....		
40,000	40,000	.00504	.00054	.00304	.00186		
41,000	41,000	.00580	.00076	.....	.....		
42,000	42,000	.00650	.00070	.....	.....		
43,000	43,000	.00734	.00084	.....	.....		
44,000	44,000	.00814	.00080	.....	.....		
45,000	45,000	.00904	.00090	.00660	.00356		
46,000	46,000	.00980	.00076	.....	.....		
47,000	47,000	.01110	.00130	.....	.....		
48,000	48,000	.01234	.00124	.....	.....		
49,000	49,000	.01390	.00156	.....	.....		
50,000	50,000	.01576	.00186	.01260	.00600		
57,200	57,200	.....	.....	.....	.....		Ultimate strength.

Failed by triple flexure.

## BODY No. 10.

No. 4584.

Marks, <sup>12 M R, T R,</sup>  
<sub>B T,</sub>

Diameter, 1".129.

Sectional area, 1 square inch.

Length of stem, 23".

Gauged length, 20".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.000055	.000055	.....	.....	
3,000	3,000	.000110	.000055	.....	.....	
4,000	4,000	.000165	.000055	.....	.....	
5,000	5,000	.000225	.000060	0.	.....	
6,000	6,000	.000285	.000060	.....	.....	
7,000	7,000	.000345	.000060	.....	.....	
8,000	8,000	.000405	.000060	.....	.....	
9,000	9,000	.000465	.000060	.....	.....	
10,000	10,000	.000535	.000070	.000030	.000030	
11,000	11,000	.000605	.000070	.....	.....	
12,000	12,000	.000690	.000085	.000055	.000025	
13,000	13,000	.000770	.000080	.....	.....	
14,000	14,000	.000855	.000085	.000095	.000040	
15,000	15,000	.000945	.000090	.....	.....	
16,000	16,000	.001050	.000105	.000155	.000080	
17,000	17,000	.001160	.000110	.....	.....	
18,000	18,000	.001280	.000120	.000245	.000090	
19,000	19,000	.001430	.000150	.....	.....	
20,000	20,000	.001600	.000170	.000410	.000165	
21,000	21,000	.001815	.000215	.....	.....	
22,000	22,000	.002050	.000235	.000695	.000285	
23,000	23,000	.002350	.000300	.....	.....	
24,000	24,000	.002700	.000350	.001195	.000500	
24,980	24,980	.....	.....	.....	.....	Tensile strength.

Fractured 4".5 from neck. Appearance, uniform, granular.

No. 4585.

Marks, <sup>12MR</sup><sub>10TR</sub>  
<sup>M T</sup><sub>1</sub>  
 Diameter, 1".129.  
 Sectional area, 1 square inch.  
 Length of stem, 23".  
 Gauged length, 20".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.000045	.000045	.....	.....	
3,000	3,000	.000090	.000045	.....	.....	
4,000	4,000	.000140	.000050	.....	.....	
5,000	5,000	.000190	.000050	0.	.....	
6,000	6,000	.000250	.000060	.....	.....	
7,000	7,000	.000300	.000050	.....	.....	
8,000	8,000	.000350	.000050	.....	.....	
9,000	9,000	.000410	.000060	.....	.....	
10,000	10,000	.000465	.000055	.000010	.000010	
11,000	11,000	.000525	.000060	.....	.....	
12,000	12,000	.000585	.000060	.000035	.000025	
13,000	13,000	.000655	.000070	.....	.....	
14,000	14,000	.000725	.000070	.000055	.000020	
15,000	15,000	.000795	.000070	.....	.....	
16,000	16,000	.000875	.000080	.000090	.000035	
17,000	17,000	.000960	.000085	.....	.....	
18,000	18,000	.001040	.000080	.000140	.000050	
19,000	19,000	.001150	.000110	.....	.....	
20,000	20,000	.001255	.000105	.000225	.000085	
21,000	21,000	.001400	.000145	.....	.....	
22,000	22,000	.001530	.000130	.000370	.000145	
23,000	23,000	.001730	.000200	.....	.....	
24,000	24,000	.001915	.000215	.000625	.000255	
25,000	25,000	.002230	.000285	.000840	.000215	
27,320	27,320	.....	.....	.....	.....	

Fractured 10" from neck. Appearance, uniform, granular.

No. 992.

Marks, <sup>12 M R T R,</sup>  
<sub>B T,</sub>  
 Length, 10'' .5.  
 Diameter, 1'' .129.  
 Sectional area, 1 square inch.  
 Gauged length, 5''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total	Per square inch.						
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.		
1,000	1,000	0.	0.	0.	0.	Initial load.	
2,000	2,000	.00004	.00004				
3,000	3,000	.00008	.00004				
4,000	4,000	.00012	.00004				
5,000	5,000	.00016	.00004	0.			
6,000	6,000	.00022	.00006				
7,000	7,000	.00028	.00006				
8,000	8,000	.00032	.00004				
9,000	9,000	.00038	.00006				
10,000	10,000	.00044	.00006	0.			
11,000	11,000	.00050	.00006				
12,000	12,000	.00056	.00006				
13,000	13,000	.00064	.00010				
14,000	14,000	.00070	.00006				
15,000	15,000	.00076	.00006	.00004	.00004		
16,000	16,000	.00080	.00004				
17,000	17,000	.00088	.00008				
18,000	18,000	.00094	.00006				
19,000	19,000	.00100	.00006				
20,000	20,000	.00106	.00006	.00014	.00010		
21,000	21,000	.00114	.00008				
22,000	22,000	.00122	.00008				
23,000	23,000	.00132	.00010				
24,000	24,000	.00140	.00008				
25,000	25,000	.00150	.00010	.00028	.00014		
26,000	26,000	.00162	.00012				
27,000	27,000	.00172	.00010				
28,000	28,000	.00184	.00012				
29,000	29,000	.00198	.00014				
30,000	30,000	.00210	.00012	.00064	.00036		
31,000	31,000	.00240	.00030				
32,000	32,000	.00256	.00016				
33,000	33,000	.00282	.00026				
34,000	34,000	.00316	.00034				
35,000	35,000	.00354	.00038	.00176	.00112		
36,000	36,000	.00396	.00042				
37,000	37,000	.00422	.00026				
38,000	38,000	.00464	.00042				
39,000	39,000	.00514	.00050				
40,000	40,000	.00576	.00062	.00376	.00200		
41,000	41,000	.00640	.00064				
42,000	42,000	.00676	.00036				
43,000	43,000	.00722	.00046				
44,000	44,000	.00810	.00088				
45,000	45,000	.00890	.00080	.00646	.00270		
46,000	46,000	.00936	.00046				
47,000	47,000	.00974	.00038				
48,000	48,000	.01050	.00070				
49,000	49,000	.01138	.00088				
50,000	50,000	.01200	.00062	.00026	.00280		
57,200	57,200						Ultimate strength.

Failed by triple flexure.



No. 993.

Marks, <sup>12 M R<sub>10</sub> T R<sub>2</sub></sup>  
<sup>B R<sub>10</sub></sup>  
 Length, 10''<sup>5</sup>/<sub>8</sub>.  
 Diameter, 1''<sup>129</sup>/<sub>1000</sub>.  
 Sectional area, 1 square inch.  
 Gauged length, 5''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0.				
2,000	2,000	.00004	.00004				
3,000	3,000	.00010	.00006				
4,000	4,000	.00016	.00006				
5,000	5,000	.00020	.00004	0.			
6,000	6,000	.00026	.00006				
7,000	7,000	.00032	.00006				
8,000	8,000	.00036	.00004				
9,000	9,000	.00042	.00006				
10,000	10,000	.00048	.00006	.00002	.00002		
11,000	11,000	.00052	.00004				
12,000	12,000	.00060	.00008				
13,000	13,000	.00066	.00006				
14,000	14,000	.00072	.00006				
15,000	15,000	.00078	.00006	.00006	.00004		
16,000	16,000	.00080	.00002				
17,000	17,000	.00088	.00008				
18,000	18,000	.00094	.00006				
19,000	19,000	.00102	.00008				
20,000	20,000	.00110	.00008	.00014	.00008		
21,000	21,000	.00118	.00008				
22,000	22,000	.00124	.00006				
23,000	23,000	.00130	.00006				
24,000	24,000	.00138	.00008				
25,000	25,000	.00148	.00010	.00020	.00012		
26,000	26,000	.00160	.00012				
27,000	27,000	.00172	.00012				
28,000	28,000	.00184	.00012				
29,000	29,000	.00198	.00014				
30,000	30,000	.00216	.00018	.00066	.00040		
31,000	31,000	.00236	.00020				
32,000	32,000	.00254	.00018				
33,000	33,000	.00276	.00022				
34,000	34,000	.00316	.00040				
35,000	35,000	.00354	.00038	.00174	.00108		
36,000	36,000	.00388	.00034				
37,000	37,000	.00426	.00038				
38,000	38,000	.00468	.00042				
39,000	39,000	.00508	.00040				
40,000	40,000	.00562	.00054	.00360	.00186		
41,000	41,000	.00624	.00062				
42,000	42,000	.00684	.00030				
43,000	43,000	.00714	.00060				
44,000	44,000	.00774	.00060				
45,000	45,000	.00858	.00084	.00636	.00276		
46,000	46,000	.00920	.00062				
47,000	47,000	.00958	.00038				
48,000	48,000	.01010	.00052				
49,000	49,000	.01090	.00080				
50,100	50,000	.01160	.00070	.00884	.00248		
58,980	58,980						Ultimate strength.

Failed by triple flexure.

No. 992.

Marks, <sup>12 M R 1 T R,</sup>  
<sub>BT,</sub>  
 Length, 10'' .5.  
 Diameter, 1'' .129.  
 Sectional area, 1 square inch.  
 Gauged length, 5''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0.	0.	0.		
2,000	2,000	.00004	.00004	.....	.....		
3,000	3,000	.00008	.00004	.....	.....		
4,000	4,000	.00012	.00004	.....	.....		
5,000	5,000	.00016	.00004	0.	.....		
6,000	6,000	.00022	.00006	.....	.....		
7,000	7,000	.00028	.00006	.....	.....		
8,000	8,000	.00032	.00004	.....	.....		
9,000	9,000	.00038	.00006	.....	.....		
10,000	10,000	.00044	.00006	0.	.....		
11,000	11,000	.00050	.00006	.....	.....		
12,000	12,000	.00056	.00006	.....	.....		
13,000	13,000	.00064	.00010	.....	.....		
14,000	14,000	.00070	.00006	.....	.....		
15,000	15,000	.00078	.00006	.00004	.00004		
16,000	16,000	.00080	.00004	.....	.....		
17,000	17,000	.00088	.00008	.....	.....		
18,000	18,000	.00094	.00006	.....	.....		
19,000	19,000	.00100	.00006	.....	.....		
20,000	20,000	.00106	.00006	.00014	.00010		
21,000	21,000	.00114	.00008	.....	.....		
22,000	22,000	.00122	.00008	.....	.....		
23,000	23,000	.00132	.00010	.....	.....		
24,000	24,000	.00140	.00008	.....	.....		
25,000	25,000	.00150	.00010	.00028	.00014		
26,000	26,000	.00162	.00012	.....	.....		
27,000	27,000	.00172	.00010	.....	.....		
28,000	28,000	.00184	.00012	.....	.....		
29,000	29,000	.00198	.00014	.....	.....		
30,000	30,000	.00210	.00012	.00064	.00036		
31,000	31,000	.00240	.00030	.....	.....		
32,000	32,000	.00256	.00016	.....	.....		
33,000	33,000	.00282	.00026	.....	.....		
34,000	34,000	.00316	.00034	.....	.....		
35,000	35,000	.00354	.00038	.00170	.00112		
36,000	36,000	.00396	.00042	.....	.....		
37,000	37,000	.00422	.00026	.....	.....		
38,000	38,000	.00464	.00042	.....	.....		
39,000	39,000	.00514	.00050	.....	.....		
40,000	40,000	.00576	.00062	.00376	.00200		
41,000	41,000	.00640	.00064	.....	.....		
42,000	42,000	.00676	.00036	.....	.....		
43,000	43,000	.00722	.00046	.....	.....		
44,000	44,000	.00810	.00088	.....	.....		
45,000	45,000	.00890	.00080	.00646	.00270		
46,000	46,000	.00936	.00046	.....	.....		
47,000	47,000	.00974	.00038	.....	.....		
48,000	48,000	.01050	.00070	.....	.....		
49,000	49,000	.01138	.00088	.....	.....		
50,000	50,000	.01200	.00062	.00626	.00280		
57,200	57,200	.....	.....	.....	.....		Ultimate strength.

Failed by triple flexure.

No. 993.

Marks, <sup>12 M R<sub>10</sub> T R<sub>2</sub></sup>  
<sub>B R<sub>10</sub></sub>  
 Length, 10'' .5.  
 Diameter, 1'' .129.  
 Sectional area, 1 square inch.  
 Gauged length, 5''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0.	0.	0.		
2,000	2,000	.00004	.00004	.....	.....		
3,000	3,000	.00010	.00006	.....	.....		
4,000	4,000	.00016	.00006	.....	.....		
5,000	5,000	.00020	.00004	0.	.....		
6,000	6,000	.00026	.00006	.....	.....		
7,000	7,000	.00032	.00006	.....	.....		
8,000	8,000	.00036	.00004	.....	.....		
9,000	9,000	.06042	.00006	.....	.....		
10,000	10,000	.00048	.00006	.00002	.00002		
11,000	11,000	.00052	.00004	.....	.....		
12,000	12,000	.00060	.00008	.....	.....		
13,000	13,000	.00066	.00006	.....	.....		
14,000	14,000	.00072	.00006	.....	.....		
15,000	15,000	.00078	.00006	.00006	.00004		
16,000	16,000	.00080	.00002	.....	.....		
17,000	17,000	.00088	.00008	.....	.....		
18,000	18,000	.00094	.00006	.....	.....		
19,000	19,000	.00102	.00008	.....	.....		
20,000	20,000	.00110	.00006	.00014	.00008		
21,000	21,000	.00118	.00008	.....	.....		
22,000	22,000	.00124	.00006	.....	.....		
23,000	23,000	.00130	.00006	.....	.....		
24,000	24,000	.00138	.00008	.....	.....		
25,000	25,000	.00148	.00010	.00020	.00012		
26,000	26,000	.00160	.00012	.....	.....		
27,000	27,000	.00172	.00012	.....	.....		
28,000	28,000	.00184	.00012	.....	.....		
29,000	29,000	.00198	.00014	.....	.....		
30,000	30,000	.00216	.00018	.00066	.00040		
31,000	31,000	.00236	.00020	.....	.....		
32,000	32,000	.00254	.00018	.....	.....		
33,000	33,000	.00276	.00022	.....	.....		
34,000	34,000	.00316	.00040	.....	.....		
35,000	35,000	.00354	.00038	.00174	.00108		
36,000	36,000	.00388	.00034	.....	.....		
37,000	37,000	.00426	.00038	.....	.....		
38,000	38,000	.00468	.00042	.....	.....		
39,000	39,000	.00508	.00040	.....	.....		
40,000	40,000	.00562	.00054	.00360	.00186		
41,000	41,000	.00624	.00062	.....	.....		
42,000	42,000	.00684	.00030	.....	.....		
43,000	43,000	.00714	.00060	.....	.....		
44,000	44,000	.00774	.00060	.....	.....		
45,000	45,000	.00858	.00084	.00636	.00276		
46,000	46,000	.00920	.00062	.....	.....		
47,000	47,000	.00958	.00038	.....	.....		
48,000	48,000	.01010	.00052	.....	.....		
49,000	49,000	.01090	.00080	.....	.....		
50,100	50,000	.01160	.00070	.00884	.00248		
58,980	58,980	.....	.....	.....	.....		Ultimate strength.

Failed by triple flexuro.

No. 994.

Marks, <sup>12 M R<sub>12</sub> T B<sub>1</sub></sup>  
<sub>M T<sub>1</sub></sub>  
 Length, 10'' . 5.  
 Diameter, 1'' . 129.  
 Sectional area, 1 square inch.  
 Gauged length, 5''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00004	.00004			
3,000	3,000	.00008	.00004			
4,000	4,000	.00012	.00004			
5,000	5,000	.00018	.00006	0.		
6,000	6,000	.00024	.00008			
7,000	7,000	.00030	.00008			
8,000	8,000	.00034	.00004			
9,000	9,000	.00040	.00006			
10,000	10,000	.00044	.00004	.00004	.00004	
11,000	11,000	.00048	.00004			
12,000	12,000	.00060	.00012			
13,000	13,000	.00066	.00006			
14,000	14,000	.00074	.00008			
15,000	15,000	.00078	.00004	.00008	.00004	
16,000	16,000	.00082	.00004			
17,000	17,000	.00090	.00008			
18,000	18,000	.00100	.00010			
19,000	19,000	.00106	.00006			
20,000	20,000	.00112	.00006	.00012	.00004	
21,000	21,000	.00120	.00008			
22,000	22,000	.00128	.00008			
23,000	23,000	.00134	.00006			
24,000	24,000	.00144	.00010			
25,000	25,000	.00154	.00010	.00030	.00018	
26,000	26,000	.00166	.00012			
27,000	27,000	.00180	.00014			
28,000	28,000	.00194	.00014			
29,000	29,000	.00210	.00016			
30,000	30,000	.00230	.00020	.00076	.00046	
31,000	31,000	.00260	.00030			
32,000	32,000	.00276	.00016			
33,000	33,000	.00296	.00020			
34,000	34,000	.00326	.00030			
35,000	35,000	.00366	.00040	.00188	.00112	
36,000	36,000	.00410	.00044			
37,000	37,000	.00446	.00030			
38,000	38,000	.00500	.00054			
39,000	39,000	.00546	.00046			
40,000	40,000	.00590	.00044	.00380	.00192	
41,000	41,000	.00662	.00072			
42,000	42,000	.00698	.00036			
43,000	43,000	.00750	.00052			
44,000	44,000	.00804	.00054			
45,000	45,000	.00880	.00076	.00036	.00256	
46,000	46,000	.00940	.00060			
47,000	47,000	.00966	.00026			
48,000	48,000	.01010	.00044			
49,000	49,000	.01056	.00046			
50,000	50,000	.01110	.00054	.00852	.00216	
56,380	56,380					Ultimate strength.

Failed by triple flexure.

## BODY No. 10 (second casting).

No. 4594.

Marks, <sup>12 M B. T R.</sup><sub>B T</sub>

Diameter, 1".129.

Sectional area, 1 square inch.

Length of stem, 23".

Gauged length, 20".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.000050	.000050	.....	.....	
3,000	3,000	.000090	.000040	.....	.....	
4,000	4,000	.000140	.000050	.....	.....	
5,000	5,000	.000190	.000050	0.	.....	
6,000	6,000	.000240	.000050	.....	.....	
7,000	7,000	.000290	.000050	.....	.....	
8,000	8,000	.000345	.000055	.....	.....	
9,000	9,000	.000400	.000055	.....	.....	
10,000	10,000	.000455	.000055	.000010	.000010	
11,000	11,000	.000510	.000055	.....	.....	
12,000	12,000	.000570	.000060	.000030	.000020	
13,000	13,000	.000850	.000080	.....	.....	
14,000	14,000	.000710	.000080	.000040	.000010	
15,000	15,000	.000780	.000070	.....	.....	
16,000	16,000	.000850	.000070	.000080	.000040	
17,000	17,000	.000940	.000090	.....	.....	
18,000	18,000	.001010	.000070	.000110	.000030	
19,000	19,000	.001120	.000110	.....	.....	
20,000	20,000	.001210	.000090	.000200	.000090	
21,000	21,000	.001350	.000140	.....	.....	
22,000	22,000	.001485	.000115	.000310	.000110	
23,000	23,000	.001645	.000180	.....	.....	
24,000	24,000	.001800	.000155	.000520	.000210	
25,000	25,000	.....	.....	.....	.....	Tensile strength.

Fractured 10" from neck. Appearance, 40 per cent uniform, granular, 60 per cent coarse granular with dark colored spangles. A well-defined line of demarcation between the two kinds of surface.

No. 4595.

Marks, <sup>12 M R<sub>10</sub> T R<sub>1</sub></sup>  
<sup>M T<sub>1</sub></sup>  
 Diameter, 1<sup>11</sup>/<sub>16</sub> 129.  
 Sectional area, 1 square inch.  
 Length of stem, 23<sup>11</sup>/<sub>16</sub>.  
 Gauged length, 20<sup>11</sup>/<sub>16</sub>.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.000050	.000050			
3,000	3,000	.000100	.000050			
4,000	4,000	.000150	.000050			
5,000	5,000	.000195	.000045	.000005	.000005	
6,000	6,000	.000240	.000045			
7,000	7,000	.000285	.000055			
8,000	8,000	.000345	.000050			
9,000	9,000	.000400	.000055			
10,000	10,000	.000450	.000050	.000020	.000015	
11,000	11,000	.000505	.000055			
12,000	12,000	.000560	.000055	.000035	.000015	
13,000	13,000	.000625	.000065			
14,000	14,000	.000685	.000060	.000055	.000020	
15,000	15,000	.000750	.000065			
16,000	16,000	.000815	.000065	.000085	.000030	
17,000	17,000	.000900	.000085			
18,000	18,000	.000985	.000085	.000135	.000050	
19,000	19,000	.001060	.000075			
20,000	20,000	.001155	.000095	.000200	.000065	
21,000	21,000	.001300	.000145			
22,000	22,000	.001400	.000100	.000310	.000110	
23,000	23,000	.001555	.000155			
24,000	24,000	.001735	.000180	.000500	.000190	
25,000	25,000	.001960	.000225	.000660	.000160	
26,940	26,940					

Fractured  $2\frac{1}{4}$ " from neck. Appearance, granular, mottled.

No. 1001.

Marks, <sup>12</sup> M R<sub>1</sub>, T R<sub>2</sub>  
<sup>B T<sub>12</sub></sup>  
 Length, 10''<sup>5</sup>.  
 Diameter, 1''<sup>129</sup>.  
 Sectional area, 1 square inch.  
 Gauged length, 5''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.00004	.00004	.....	.....	
3,000	3,000	.00010	.00006	.....	.....	
4,000	4,000	.00016	.00006	.....	.....	
5,000	5,000	.00020	.00004	0.	.....	
6,000	6,000	.00026	.00006	.....	.....	
7,000	7,000	.00030	.00004	.....	.....	
8,000	8,000	.00036	.00006	.....	.....	
9,000	9,000	.00040	.00004	.....	.....	
10,000	10,000	.00048	.00008	.00004	.00004	
11,000	11,000	.00054	.00006	.....	.....	
12,000	12,000	.00060	.00006	.....	.....	
13,000	13,000	.00064	.00004	.....	.....	
14,000	14,000	.00070	.00006	.....	.....	
15,000	15,000	.00076	.00006	.00010	.00006	
16,000	16,000	.00080	.00004	.....	.....	
17,000	17,000	.00086	.00006	.....	.....	
18,000	18,000	.00094	.00008	.....	.....	
19,000	19,000	.00100	.00006	.....	.....	
20,000	20,000	.00106	.00006	.00016	.00006	
21,000	21,000	.00114	.00008	.....	.....	
22,000	22,000	.00120	.00006	.....	.....	
23,000	23,000	.00126	.00006	.....	.....	
24,000	24,000	.00134	.00008	.....	.....	
25,000	25,000	.00142	.00008	.00028	.00012	
26,000	26,000	.00154	.00012	.....	.....	
27,000	27,000	.00160	.00006	.....	.....	
28,000	28,000	.00174	.00014	.....	.....	
29,000	29,000	.00182	.00008	.....	.....	
30,000	30,000	.00194	.00012	.00054	.00026	
31,000	31,000	.00208	.00014	.....	.....	
32,000	32,000	.00226	.00020	.....	.....	
33,000	33,000	.00248	.00020	.....	.....	
34,000	34,000	.00268	.00020	.....	.....	
35,000	35,000	.00294	.00028	.00126	.00072	
36,000	36,000	.00326	.00032	.....	.....	
37,000	37,000	.00356	.00030	.....	.....	
38,000	38,000	.00400	.00044	.....	.....	
39,000	39,000	.00446	.00046	.....	.....	
40,000	40,000	.00486	.00040	.00294	.00168	
41,000	41,000	.00540	.00054	.....	.....	
42,000	42,000	.00590	.00050	.....	.....	
43,000	43,000	.00646	.00056	.....	.....	
44,000	44,000	.00700	.00054	.....	.....	
45,000	45,000	.00788	.00088	.00560	.00286	
46,000	46,000	.00856	.00070	.....	.....	
47,000	47,000	.00928	.00072	.....	.....	
48,000	48,000	.00992	.00064	.....	.....	
49,000	49,000	.01074	.00082	.....	.....	
50,000	50,000	.01204	.00130	.00932	.00372	
50,200	50,200	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

No. 1002.

Marks, <sup>12 M R<sub>10</sub> T R<sub>2</sub></sup>  
<sub>B R<sub>20</sub></sub>

Length, 10<sup>1</sup>/<sub>5</sub>.

Diameter, 1<sup>1</sup>/<sub>129</sub>.

Sectional area, 1 square inch.

Gauged length, 5<sup>1</sup>/<sub>2</sub>.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0.	0.	0.		
2,000	2,000	.00006	.00006	.....	.....		
3,000	3,000	.00010	.00010	.....	.....		
4,000	4,000	.00014	.00014	.....	.....		
5,000	5,000	.00018	.00018	.....	0.		
6,000	6,000	.00022	.00022	.....	.....		
7,000	7,000	.00023	.00023	.....	.....		
8,000	8,000	.00034	.00034	.....	.....		
9,000	9,000	.00038	.00038	.....	.....		
10,000	10,000	.00044	.00044	.00002	.00002		
11,000	11,000	.00050	.00050	.....	.....		
12,000	12,000	.00054	.00054	.00014	.....		
13,000	13,000	.00060	.00060	.....	.....		
14,000	14,000	.00064	.00064	.00014	.....		
15,000	15,000	.00070	.00070	.00002	0.		
16,000	16,000	.00072	.00072	.00002	.....		
17,000	17,000	.00076	.00076	.....	.....		
18,000	18,000	.00084	.00084	.....	.....		
19,000	19,000	.00090	.00090	.....	.....		
20,000	20,000	.00096	.00096	.00008	.00008		
21,000	21,000	.00102	.00102	.....	.....		
22,000	22,000	.00110	.00110	.....	.....		
23,000	23,000	.00116	.00116	.....	.....		
24,000	24,000	.00122	.00122	.....	.....		
25,000	25,000	.00130	.00130	.00008	.00004		
26,000	26,000	.00140	.00140	.....	.....		
27,000	27,000	.00148	.00148	.....	.....		
28,000	28,000	.00158	.00158	.00010	.....		
29,000	29,000	.00166	.00166	.00008	.....		
30,000	30,000	.00180	.00180	.00014	.00012		
31,000	31,000	.00198	.00198	.00018	.....		
32,000	32,000	.00210	.00210	.....	.....		
33,000	33,000	.00234	.00234	.00018	.....		
34,000	34,000	.00256	.00256	.00022	.....		
35,000	35,000	.00294	.00294	.00130	.00106		
36,000	36,000	.00322	.00322	.....	.....		
37,000	37,000	.00354	.00354	.....	.....		
38,000	38,000	.00400	.00400	.....	.....		
39,000	39,000	.00448	.00448	.....	.....		
40,000	40,000	.00484	.00484	.00296	.00166		
41,000	41,000	.00532	.00532	.....	.....		
42,000	42,000	.00570	.00570	.....	.....		
43,000	43,000	.00630	.00630	.....	.....		
44,000	44,000	.00684	.00684	.....	.....		
45,000	45,000	.00740	.00740	.00518	.00222		
46,000	46,000	.00786	.00786	.....	.....		
47,000	47,000	.00834	.00834	.....	.....		
48,000	48,000	.00886	.00886	.00552	.....		
49,000	49,000	.00924	.00924	.00038	.....		
50,000	50,000	.00970	.00970	.00726	.00206		
58,980	58,980	.....	.....	.....	.....		Ultimate strength.

Failed by triple flexure,



No. 1003.

Marks, <sup>12</sup>M R<sub>12</sub> T R<sub>1</sub>  
<sup>M</sup> T<sub>12</sub>

Length, 10'' .5.

Diameter 1'' .129.

Sectional area, 1 square inch.

Gauged length, 5''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0.	0.	0.		
2,000	2,000	.00004	.00004				
3,000	3,000	.00008	.00004				
4,000	4,000	.00012	.00004				
5,000	5,000	.00018	.00008	0.			
6,000	6,000	.00024	.00008				
7,000	7,000	.00028	.00004				
8,000	8,000	.00032	.00004				
9,000	9,000	.00038	.00008				
10,000	10,000	.00042	.00004	.00002	.00002		
11,000	11,000	.00048	.00008				
12,000	12,000	.00054	.00008				
13,000	13,000	.00060	.00008				
14,000	14,000	.00064	.00004				
15,000	15,000	.00070	.00008	.00004	.00002		
16,000	16,000	.00076	.00008				
17,000	17,000	.00080	.00004				
18,000	18,000	.00086	.00008				
19,000	19,000	.00092	.00008				
20,000	20,000	.00098	.00008	.00014	.00010		
21,000	21,000	.00104	.00008				
22,000	22,000	.00110	.00008				
23,000	23,000	.00118	.00008				
24,000	24,000	.00124	.00008				
25,000	25,000	.00132	.00008	.00020	.00006		
26,000	26,000	.00138	.00008				
27,000	27,000	.00146	.00008				
28,000	28,000	.00156	.00010				
29,000	29,000	.00170	.00014				
30,000	30,000	.00180	.00010	.00044	.00024		
31,000	31,000	.00196	.00016				
32,000	32,000	.00214	.00018				
33,000	33,000	.00234	.00020				
34,000	34,000	.00264	.00030				
35,000	35,000	.00290	.00028	.00130	.00086		
36,000	36,000	.00330	.00040				
37,000	37,000	.00360	.00030				
38,000	38,000	.00394	.00034				
39,000	39,000	.00440	.00048				
40,000	40,000	.00496	.00056	.00306	.00176		
41,000	41,000	.00546	.00050				
42,000	42,000	.00596	.00040				
43,000	43,000	.00640	.00054				
44,000	44,000	.00690	.00050				
45,000	45,000	.00740	.00050	.00524	.00218		
46,000	46,000	.00788	.00048				
47,000	47,000	.00822	.00034				
48,000	48,000	.00854	.00032				
49,000	49,000	.00880	.00028				
50,000	50,000	.00898	.00018	.00674	.00150		
57,970	57,970						Ultimate strength.

Failed by triple flexure.

H. Ex. 43—11

BODY No. 10 (fourth casting).

No. 4618.

Marks, <sup>12 M R, TR,</sup>  
<sup>B T,</sup>  
 Diameter, 1".129.  
 Sectional area, 1 square inch.  
 Length of stem, 23".  
 Gauged length, 20".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.000050	.000050	.....	.....	
3,000	3,000	.000100	.000050	.....	.....	
4,000	4,000	.000150	.000050	.....	.....	
5,000	5,000	.000200	.000050	0.	.....	
6,000	6,000	.000250	.000050	.....	.....	
7,000	7,000	.000305	.000055	.....	.....	
8,000	8,000	.000355	.000050	.....	.....	
9,000	9,000	.000410	.000055	.....	.....	
10,000	10,000	.000470	.000060	.000015	.000015	
11,000	11,000	.000535	.000065	.....	.....	
12,000	12,000	.000595	.000060	.000020	.000005	
13,000	13,000	.000660	.000065	.....	.....	
14,000	14,000	.000735	.000075	.000055	.000035	
15,000	15,000	.000805	.000070	.....	.....	
16,000	16,000	.000880	.000075	.000090	.000035	
17,000	17,000	.000970	.000090	.....	.....	
18,000	18,000	.001060	.000090	.000145	.000055	
19,000	19,000	.001150	.000090	.....	.....	
20,000	20,000	.001260	.000110	.000225	.000060	
21,000	21,000	.001390	.000130	.....	.....	
22,000	22,000	.001530	.000140	.000360	.000135	
23,000	23,000	.001700	.000170	.....	.....	
24,000	24,000	.001900	.000200	.000575	.000215	
25,000	25,000	.002150	.000250	.000755	.000180	
29,910	29,910	.....	.....	.....	.....	Tensile strength.

Fractured 8".5 from neck. Appearance, granular.

No. 4619.

Marks, <sup>12 M R. T R.</sup>  
<sup>M T.</sup>  
 Diameter, 1".129.  
 Sectional area, 1 square inch.  
 Length of stem, 23".  
 Gauged length, 20".

Applied loads.		Elongation.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.000050	.000050	.....	.....	
3,000	3,000	.000100	.000050	.....	.....	
4,000	4,000	.000145	.000045	.....	.....	
5,000	5,000	.000195	.000050	0.	.....	
6,000	6,000	.000240	.000045	.....	.....	
7,000	7,000	.000290	.000050	.....	.....	
8,000	8,000	.000335	.000045	.....	.....	
9,000	9,000	.000385	.000050	.....	.....	
10,000	10,000	.000435	.000050	.000010	.000010	
11,000	11,000	.000490	.000055	.....	.....	
12,000	12,000	.000540	.000050	.000025	.000015	
13,000	13,000	.000595	.000055	.....	.....	
14,000	14,000	.000650	.000055	.000035	.000010	
15,000	15,000	.000715	.000065	.....	.....	
16,000	16,000	.000775	.000060	.000060	.000025	
17,000	17,000	.000840	.000065	.....	.....	
18,000	18,000	.000910	.000070	.000060	.000030	
19,000	19,000	.000990	.000060	.....	.....	
20,000	20,000	.001070	.000080	.000130	.000040	
21,000	21,000	.001145	.000075	.....	.....	
22,000	22,000	.001225	.000080	.000190	.000060	
23,000	23,000	.001325	.000100	.....	.....	
24,000	24,000	.001425	.000100	.000280	.000060	
25,000	25,000	.001600	.000175	.000380	.000100	
28,140	28,140	.....	.....	.....	.....	Tensile strength.

Fractured at neck. Appearance, granular.

No. 1025.

Marks,  $12 M R_{10} T B_2$   
 $B 1_{23}$   
 Length,  $10' .5$ .  
 Diameter,  $1'' .129$ .  
 Sectional area, 1 square inch.  
 Gauged length,  $5''$ .

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0.	0.	0.		
2,000	2,000	.00004	.00004	.....	.....		
3,000	3,000	.00008	.00004	.....	.....		
4,000	4,000	.00012	.00004	.....	.....		
5,000	5,000	.00018	.00004	0.	.....		
6,000	6,000	.00020	.00004	.....	.....		
7,000	7,000	.00024	.00004	.....	.....		
8,000	8,000	.00028	.00004	.....	.....		
9,000	9,000	.00032	.00004	0.	.....		
10,000	10,000	.00038	.00006	.....	.....		
11,000	11,000	.00044	.00006	.....	.....		
12,000	12,000	.00052	.00008	.....	.....		
13,000	13,000	.00056	.00008	.....	.....		
14,000	14,000	.00060	.00004	.....	.....		
15,000	15,000	.00064	.00004	.00008	.00008		
16,000	16,000	.00070	.00006	.....	.....		
17,000	17,000	.00074	.00004	.....	.....		
18,000	18,000	.00080	.00000	.....	.....		
19,000	19,000	.00084	.00004	.....	.....		
20,000	20,000	.00090	.00006	.00012	.00004		
21,000	21,000	.00100	.00010	.....	.....		
22,000	22,000	.00110	.00010	.....	.....		
23,000	23,000	.00120	.00010	.....	.....		
24,000	24,000	.00128	.00008	.....	.....		
25,000	25,000	.00136	.00008	.00022	.00010		
26,000	26,000	.00144	.00008	.....	.....		
27,000	27,000	.00152	.00008	.....	.....		
28,000	28,000	.00160	.00008	.....	.....		
29,000	29,000	.00170	.00010	.....	.....		
30,000	30,000	.00180	.00010	.00040	.00018		
31,000	31,000	.00192	.00012	.....	.....		
32,000	32,000	.00210	.00018	.....	.....		
33,000	33,000	.00226	.00016	.....	.....		
34,000	34,000	.00246	.00020	.....	.....		
35,000	35,000	.00278	.00032	.00110	.00070		
36,000	36,000	.00310	.00032	.....	.....		
37,000	37,000	.00344	.00034	.....	.....		
38,000	38,000	.00380	.00036	.....	.....		
39,000	39,000	.00410	.00030	.....	.....		
40,000	40,000	.00466	.00066	.00270	.00160		
41,000	41,000	.00520	.00054	.....	.....		
42,000	42,000	.00500	.00040	.....	.....		
43,000	43,000	.00608	.00048	.....	.....		
44,000	44,000	.00672	.00064	.....	.....		
45,000	45,000	.00736	.00064	.00500	.00230		
46,000	46,000	.00790	.00054	.....	.....		
47,000	47,000	.00848	.00058	.....	.....		
48,000	48,000	.00906	.00058	.....	.....		
49,000	49,000	.00970	.00064	.....	.....		
50,000	50,000	.01060	.00090	.00792	.00292		
60,380	60,380	.....	.....	.....	.....		Ultimate strength.

Failed by triple flexure.

No. 1026.

Marks, <sup>12 M R<sub>10</sub> T R<sub>2</sub></sup>  
<sub>B R<sub>20</sub></sub>

Length, 10' 5.

Diameter, 1" .129.

Sectional area, 1 square inch.

Gauged length, 5'.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0.	0.	0.		
2,000	2,000	.00004	.00004	.....	.....		
3,000	3,000	.00010	.00006	.....	.....		
4,000	4,000	.00014	.00004	.....	.....		
5,000	5,000	.00020	.00006	.00002	.00002		
6,000	6,000	.00026	.00006	.....	.....		
7,000	7,000	.00030	.00004	.....	.....		
8,000	8,000	.00036	.00006	.....	.....		
9,000	9,000	.00040	.00004	.....	.....		
10,000	10,000	.00046	.00006	.00004	.00002		
11,000	11,000	.00052	.00006	.....	.....		
12,000	12,000	.00058	.00006	.....	.....		
13,000	13,000	.00064	.00006	.....	.....		
14,000	14,000	.00068	.00004	.....	.....		
15,000	15,000	.00072	.00004	.00006	.00002		
16,000	16,000	.00078	.00006	.....	.....		
17,000	17,000	.00084	.00006	.....	.....		
18,000	18,000	.00088	.00004	.....	.....		
19,000	19,000	.00094	.00006	.....	.....		
20,000	20,000	.00100	.00006	.00010	.00004		
21,000	21,000	.00108	.00008	.....	.....		
22,000	22,000	.00116	.00008	.....	.....		
23,000	23,000	.00122	.00006	.....	.....		
24,000	24,000	.00128	.00006	.....	.....		
25,000	25,000	.00134	.00006	.00018	.00008		
26,000	26,000	.00142	.00008	.....	.....		
27,000	27,000	.00152	.00010	.....	.....		
28,000	28,000	.00160	.00008	.....	.....		
29,000	29,000	.00170	.00010	.....	.....		
30,000	30,000	.00182	.00012	.00042	.00024		
31,000	31,000	.00198	.00016	.....	.....		
32,000	32,000	.00214	.00016	.....	.....		
33,000	33,000	.00230	.00016	.....	.....		
34,000	34,000	.00254	.00024	.....	.....		
35,000	35,000	.00280	.00026	.00118	.00076		
36,000	36,000	.00312	.00032	.....	.....		
37,000	37,000	.00348	.00036	.....	.....		
38,000	38,000	.00392	.00044	.....	.....		
39,000	39,000	.00442	.00050	.....	.....		
40,000	40,000	.00488	.00046	.00290	.00172		
41,000	41,000	.00538	.00050	.....	.....		
42,000	42,000	.00588	.00059	.....	.....		
43,000	43,000	.00650	.00062	.....	.....		
44,000	44,000	.00696	.00046	.....	.....		
45,000	45,000	.00762	.00066	.00524	.00232		
46,000	46,000	.00820	.00058	.....	.....		
47,000	47,000	.00890	.00060	.....	.....		
48,000	48,000	.00940	.00060	.....	.....		
49,000	49,000	.01010	.00070	.....	.....		
50,000	50,000	.01120	.00110	.00860	.00336		
60,650	60,650	.....	.....	.....	.....		Ultimate strength.

Failed by triple flexure.

No. 1027.

Marks, <sup>12 M R, T R,</sup>  
<sup>M T,</sup>  
 Length, 10' 5".  
 Diameter, 1" .129.  
 Sectional area, 1 square inch.  
 Gauged length, 5'.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0.	0.	0.		
2,000	2,000	.00006	.00006				
3,000	3,000	.00010	.00010				
4,000	4,000	.00014	.00014				
5,000	5,000	.00018	.00018	.00002	.00002		
6,000	6,000	.00024	.00024				
7,000	7,000	.00030	.00030				
8,000	8,000	.00034	.00034				
9,000	9,000	.00038	.00038				
10,000	10,000	.00044	.00044	.00004	.00002		
11,000	11,000	.00050	.00050				
12,000	12,000	.00056	.00056				
13,000	13,000	.00060	.00060				
14,000	14,000	.00064	.00064				
15,000	15,000	.00068	.00068	.00006	.00002		
16,000	16,000	.00074	.00074				
17,000	17,000	.00078	.00078				
18,000	18,000	.00082	.00082				
19,000	19,000	.00088	.00088				
20,000	20,000	.00094	.00094	.00010	.00004		
21,000	21,000	.00100	.00100				
22,000	22,000	.00106	.00106				
23,000	23,000	.00112	.00112				
24,000	24,000	.00120	.00120				
25,000	25,000	.00126	.00126	.00018	.00008		
26,000	26,000	.00132	.00132				
27,000	27,000	.00138	.00138				
28,000	28,000	.00148	.00148				
29,000	29,000	.00158	.00158				
30,000	30,000	.00166	.00166	.00032	.00014		
31,000	31,000	.00178	.00178				
32,000	32,000	.00188	.00188				
33,000	33,000	.00206	.00206				
34,000	34,000	.00218	.00218				
35,000	35,000	.00240	.00240	.00078	.00046		
36,000	36,000	.00264	.00264				
37,000	37,000	.00300	.00300				
38,000	38,000	.00350	.00350				
39,000	39,000	.00376	.00376				
40,000	40,000	.00414	.00414	.00230	.00152		
41,000	41,000	.00470	.00470				
42,000	42,000	.00518	.00518				
43,000	43,000	.00572	.00572				
44,000	44,000	.00624	.00624				
45,000	45,000	.00688	.00688	.00480	.00250		
46,000	46,000	.00758	.00758				
47,000	47,000	.00800	.00800				
48,000	48,000	.00860	.00860				
49,000	49,000	.00930	.00930				
50,000	50,000	.01000	.00970	.00758	.00278		
58,620	58,620						Ultimate strength.

Failed by triple flexure.

Body No. 11.

No. 4586.

Marks, <sup>12 M R<sub>1</sub> T R<sub>2</sub></sup>  
<sub>B T<sub>1</sub></sub>  
 Diameter, 1".129.  
 Sectional area, 1 square inch.  
 Length of stem, 23".  
 Gauged length, 20".

Applied loads.		Elongation per Inch.	Successive elongation per Inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square Inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.000050	.000050			
3,000	3,000	.000100	.000050			
4,000	4,000	.000150	.000050			
5,000	5,000	.000205	.000055	.000005	.000005	
6,000	6,000	.000255	.000050			
7,000	7,000	.000305	.000050			
8,000	8,000	.000350	.000055			
9,000	9,000	.000415	.000055			
10,000	10,000	.000480	.000065	.000030	.000025	
11,000	11,000	.000550	.000070			
12,000	12,000	.000605	.000055	.000045	.000015	
13,000	13,000	.000680	.000075			
14,000	14,000	.000755	.000075	.000075	.000030	
15,000	15,000	.000835	.000080			
16,000	16,000	.000910	.000075	.000110	.000085	
17,000	17,000	.001005	.000085			
18,000	18,000	.001095	.000090	.000170	.000060	
19,000	19,000	.001210	.000115			
20,000	20,000	.001335	.000125	.000285	.000115	
21,000	21,000	.001405	.000130			
22,000	22,000	.001640	.000175	.000440	.000155	
23,000	23,000	.001850	.000210			
24,000	24,000	.002060	.000210	.000710	.000270	
25,000	25,000	.002450	.000390	.001000	.000290	
29,340	29,340					Tensile strength.

Fractured 1" from neck. Appearance, uniform, granular.

No. 1027.

Marks, <sup>12</sup> M R, <sup>1</sup> T B,  
<sup>M T</sup>  
 Length, 10''<sup>5</sup>.  
 Diameter, 1''<sup>129</sup>.  
 Sectional area, 1 square inch.  
 Gauged length, 5''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.00006	.00006	.....	.....	
3,000	3,000	.00010	.00010	.....	.....	
4,000	4,000	.00014	.00014	.....	.....	
5,000	5,000	.00018	.00018	.00002	.00002	
6,000	6,000	.00024	.00024	.....	.....	
7,000	7,000	.00030	.00030	.....	.....	
8,000	8,000	.00034	.00034	.....	.....	
9,000	9,000	.00038	.00038	.....	.....	
10,000	10,000	.00044	.00044	.00004	.00002	
11,000	11,000	.00050	.00050	.....	.....	
12,000	12,000	.00056	.00056	.....	.....	
13,000	13,000	.00060	.00060	.....	.....	
14,000	14,000	.00064	.00064	.....	.....	
15,000	15,000	.00068	.00068	.00006	.00002	
16,000	16,000	.00074	.00074	.....	.....	
17,000	17,000	.00078	.00078	.....	.....	
18,000	18,000	.00082	.00082	.....	.....	
19,000	19,000	.00088	.00088	.....	.....	
20,000	20,000	.00094	.00094	.00010	.00004	
21,000	21,000	.00100	.00100	.....	.....	
22,000	22,000	.00106	.00106	.....	.....	
23,000	23,000	.00112	.00112	.....	.....	
24,000	24,000	.00120	.00120	.....	.....	
25,000	25,000	.00126	.00126	.00018	.00008	
26,000	26,000	.00132	.00132	.....	.....	
27,000	27,000	.00138	.00138	.....	.....	
28,000	28,000	.00148	.00148	.....	.....	
29,000	29,000	.00158	.00158	.....	.....	
30,000	30,000	.00166	.00166	.00032	.00014	
31,000	31,000	.00178	.00178	.....	.....	
32,000	32,000	.00188	.00188	.....	.....	
33,000	33,000	.00206	.00206	.....	.....	
34,000	34,000	.00218	.00218	.....	.....	
35,000	35,000	.00240	.00240	.00078	.00046	
36,000	36,000	.00264	.00264	.....	.....	
37,000	37,000	.00300	.00300	.....	.....	
38,000	38,000	.00350	.00350	.....	.....	
39,000	39,000	.00376	.00376	.....	.....	
40,000	40,000	.00414	.00414	.00230	.00152	
41,000	41,000	.00470	.00470	.....	.....	
42,000	42,000	.00518	.00518	.....	.....	
43,000	43,000	.00572	.00572	.....	.....	
44,000	44,000	.00624	.00624	.....	.....	
45,000	45,000	.00688	.00688	.00480	.00250	
46,000	46,000	.00758	.00758	.....	.....	
47,000	47,000	.00800	.00800	.....	.....	
48,000	48,000	.00860	.00860	.....	.....	
49,000	49,000	.00930	.00930	.....	.....	
50,000	50,000	.01000	.00970	.00758	.00278	
58,620	58,620	.....	.....	.....	.....	

Ultimate strength.

Failed by triple flexure.



## BODY No. 11.

No. 4586.

Marks, <sup>12 M R<sub>1</sub> T R<sub>2</sub></sup><sub>B T<sub>1</sub></sub>Diameter, 1<sup>11</sup>/<sub>129</sub>.

Sectional area, 1 square inch.

Length of stem, 23<sup>11</sup>/.Gauged length, 20<sup>11</sup>/.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>		
1,000	1,000	0.	0.	0.	0.	Initial load.	
2,000	2,000	.000050	.000050	.....	.....		
3,000	3,000	.000100	.000050	.....	.....		
4,000	4,000	.000150	.000050	.....	.....		
5,000	5,000	.000205	.000055	.000005	.000005		
6,000	6,000	.000255	.000050	.....	.....		
7,000	7,000	.000305	.000050	.....	.....		
8,000	8,000	.000360	.000055	.....	.....		
9,000	9,000	.000415	.000055	.....	.....		
10,000	10,000	.000480	.000065	.000030	.000025		
11,000	11,000	.000550	.000070	.....	.....		
12,000	12,000	.000605	.000055	.000045	.000015		
13,000	13,000	.000680	.000075	.....	.....		
14,000	14,000	.000755	.000075	.000075	.000030		
15,000	15,000	.000835	.000080	.....	.....		
16,000	16,000	.000910	.000075	.000110	.000035		
17,000	17,000	.001005	.000085	.....	.....		
18,000	18,000	.001095	.000090	.000170	.000060		
19,000	19,000	.001210	.000115	.....	.....		
20,000	20,000	.001335	.000125	.000285	.000115		
21,000	21,000	.001465	.000130	.....	.....		
22,000	22,000	.001640	.000175	.000440	.000155		
23,000	23,000	.001850	.000210	.....	.....		
24,000	24,000	.002060	.000210	.000710	.000270		
25,000	25,000	.002450	.000390	.001000	.000290		
29,340	29,340	.....	.....	.....	.....		Tensile strength.

Fractured 1<sup>11</sup>/ from neck. Appearance, uniform, granular.

No. 4587.

Marks, <sup>12 M R, T B,</sup>  
<sub>M T,</sub>  
 Diameter, 1".129.  
 Sectional area, 1 square inch.  
 Length of stem, 23".  
 Gauged length, 20".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0	0	
2,000	2,000	.000045	.000045	-----	-----	
3,000	3,000	.000090	.000045	-----	-----	
4,000	4,000	.000140	.000050	-----	-----	
5,000	5,000	.000190	.000050	0	-----	
6,000	6,000	.000235	.000045	-----	-----	
7,000	7,000	.000285	.000050	-----	-----	
8,000	8,000	.000335	.000050	-----	-----	
9,000	9,000	.000385	.000050	-----	-----	
10,000	10,000	.000435	.000050	.000010	.000010	
11,000	11,000	.000495	.000060	-----	-----	
12,000	12,000	.000550	.000055	.000030	.000020	
13,000	13,000	.000620	.000070	-----	-----	
14,000	14,000	.000680	.000060	.000050	.000020	
15,000	15,000	.000745	.000065	-----	-----	
16,000	16,000	.000810	.000065	.000085	.000035	
17,000	17,000	.000890	.000080	-----	-----	
18,000	18,000	.000960	.000070	.000130	.000045	
19,000	19,000	.001060	.000100	-----	-----	
20,000	20,000	.001155	.000095	.000195	.000065	
21,000	21,000	.001260	.000105	-----	-----	
22,000	22,000	.001390	.000130	.000300	.000105	
23,000	23,000	.001540	.000150	-----	-----	
24,000	24,000	.001675	.000135	.000455	.000155	
25,000	25,000	.001900	.000225	.000605	.000150	
27,500	27,500	-----	-----	-----	-----	Tensile strength.

Fractured  $\frac{3}{4}$ " from neck. Appearance, uniform, granular.

No. 995.

Marks, <sup>12 M R<sub>1</sub> T R<sub>2</sub></sup>  
<sub>B T<sub>1</sub></sub>

Length, 10'' .5.

Diameter, 1'' .129.

Sectional area, 1 square inch.

Gauged length, 5''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.00004	.00004	.....	.....	
3,000	3,000	.00010	.00008	.....	.....	
4,000	4,000	.00016	.00006	.....	.....	
5,000	5,000	.00020	.00004	0.	.....	
6,000	6,000	.00026	.00006	.....	.....	
7,000	7,000	.00032	.00006	.....	.....	
8,000	8,000	.00038	.00006	.....	.....	
9,000	9,000	.00042	.00004	.....	.....	
10,000	10,000	.00048	.00006	.00004	.00004	
11,000	11,000	.00052	.00004	.....	.....	
12,000	12,000	.00058	.00006	.....	.....	
13,000	13,000	.00066	.00008	.....	.....	
14,000	14,000	.00072	.00006	.....	.....	
15,000	15,000	.00078	.00006	.00008	.00004	
16,000	16,000	.00086	.00008	.....	.....	
17,000	17,000	.00092	.00006	.....	.....	
18,000	18,000	.00096	.00004	.....	.....	
19,000	19,000	.00104	.00008	.....	.....	
20,000	20,000	.00110	.00006	.00012	.00004	
21,000	21,000	.00116	.00006	.....	.....	
22,000	22,000	.00122	.00006	.....	.....	
23,000	23,000	.00132	.00010	.....	.....	
24,000	24,000	.00142	.00010	.....	.....	
25,000	25,000	.00150	.00008	.00022	.00010	
26,000	26,000	.00156	.00006	.....	.....	
27,000	27,000	.00166	.00010	.....	.....	
28,000	28,000	.00176	.00010	.....	.....	
29,000	29,000	.00190	.00014	.....	.....	
30,000	30,000	.00208	.00018	.00056	.00034	
31,000	31,000	.00222	.00014	.....	.....	
32,000	32,000	.00240	.00018	.....	.....	
33,000	33,000	.00266	.00026	.....	.....	
34,000	34,000	.00290	.00024	.....	.....	
35,000	35,000	.00324	.00084	.00150	.00094	
36,000	36,000	.00358	.00034	.....	.....	
37,000	37,000	.00386	.00028	.....	.....	
38,000	38,000	.00426	.00040	.....	.....	
39,000	39,000	.00474	.00048	.....	.....	
40,000	40,000	.00532	.00058	.00334	.00184	
41,000	41,000	.00576	.00044	.....	.....	
42,000	42,000	.00620	.00044	.....	.....	
43,000	43,000	.00676	.00056	.....	.....	
44,000	44,000	.00740	.00064	.....	.....	
45,000	45,000	.00798	.00058	.00460	.00126	
46,000	46,000	.00860	.00062	.....	.....	
47,000	47,000	.00816	.00056	.....	.....	
48,000	48,000	.00894	.00078	.....	.....	
49,000	49,000	.01076	.00082	.....	.....	
50,000	50,000	.01174	.00098	.00910	.00460	
60,020	60,020	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

No. 996.

Marks <sup>12 M R<sub>11</sub> T R<sub>2</sub></sup>  
<sup>B K<sub>10</sub></sup>  
 Length, 10''<sup>5</sup>.  
 Diameter, 1''<sup>129</sup>.  
 Sectional area, 1 square inch.  
 Gauged length, 5''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0.	0.	0.		
2,000	2,000	.00004	.00004	.....	.....		
3,000	3,000	.00008	.00004	.....	.....		
4,000	4,000	.00014	.00006	.....	.....		
5,000	5,000	.00018	.00004	0.	.....		
6,000	6,000	.00022	.00004	.....	.....		
7,000	7,000	.00028	.00006	.....	.....		
8,000	8,000	.00034	.00006	.....	.....		
9,000	9,000	.00040	.00006	.....	.....		
10,000	10,000	.00044	.00004	0.	.....		
11,000	11,000	.00048	.00004	.....	.....		
12,000	12,000	.00054	.00006	.....	.....		
13,000	13,000	.00060	.00006	.....	.....		
14,000	14,000	.00066	.00006	.....	.....		
15,000	15,000	.00072	.00006	.00004	.00004		
16,000	16,000	.00076	.00004	.....	.....		
17,000	17,000	.00082	.00006	.....	.....		
18,000	18,000	.00088	.00006	.....	.....		
19,000	19,000	.00094	.00006	.....	.....		
20,000	20,000	.00100	.00006	.00008	.00004		
21,000	21,000	.00106	.00006	.....	.....		
22,000	22,000	.00114	.00008	.....	.....		
23,000	23,000	.00120	.00006	.....	.....		
24,000	24,000	.00128	.00008	.....	.....		
25,000	25,000	.00136	.00008	.00022	.00014		
26,000	26,000	.00150	.00014	.....	.....		
27,000	27,000	.00160	.00010	.....	.....		
28,000	28,000	.00170	.00010	.....	.....		
29,000	29,000	.00180	.00010	.....	.....		
30,000	30,000	.00196	.00016	.00050	.00028		
31,000	31,000	.00214	.00018	.....	.....		
32,000	32,000	.00232	.00018	.....	.....		
33,000	33,000	.00256	.00024	.....	.....		
34,000	34,000	.00288	.00030	.....	.....		
35,000	35,000	.00318	.00032	.00148	.00098		
36,000	36,000	.00346	.00028	.....	.....		
37,000	37,000	.00384	.00038	.....	.....		
38,000	38,000	.00424	.00040	.....	.....		
39,000	39,000	.00480	.00056	.....	.....		
40,000	40,000	.00524	.00044	.00334	.00186		
41,000	41,000	.00580	.00056	.....	.....		
42,000	42,000	.00620	.00040	.....	.....		
43,000	43,000	.00680	.00060	.....	.....		
44,000	44,000	.00732	.00052	.....	.....		
45,000	45,000	.00812	.00080	.00580	.00246		
46,000	46,000	.00860	.00048	.....	.....		
47,000	47,000	.00918	.00058	.....	.....		
48,000	48,000	.00998	.00080	.....	.....		
49,000	49,000	.01070	.00072	.....	.....		
50,000	50,000	.01186	.00066	.00882	.00302		
61,660	61,660	.....	.....	.....	.....		Ultimate strength.

Failed by triple flexure.

No. 997.

Marks, <sup>12</sup>M R<sub>11</sub> T R<sub>1</sub>  
<sup>M T<sub>1</sub></sup>  
 Length, 10''<sup>5</sup>.  
 Diameter, 1''<sup>.129</sup>.  
 Sectional area, 1 square inch.  
 Gauged length, 5''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0.	0.	0.		
2,000	2,000	.00008	.00008				
3,000	3,000	.00010	.00004				
4,000	4,000	.00014	.00004				
5,000	5,000	.00018	.00004	.00002	.00002		
6,000	6,000	.00024	.00006				
7,000	7,000	.00028	.00004				
8,000	8,000	.00032	.00004				
9,000	9,000	.00038	.00006				
10,000	10,000	.00042	.00004	.00004	.00002		
11,000	11,000	.00046	.00004				
12,000	12,000	.00052	.00006				
13,000	13,000	.00058	.00008				
14,000	14,000	.00062	.00004				
15,000	15,000	.00068	.00006	.00004	0.		
16,000	16,000	.00074	.00008				
17,000	17,000	.00080	.00008				
18,000	18,000	.00086	.00006				
19,000	19,000	.00092	.00006				
20,000	20,000	.00098	.00006	.00008	.00004		
21,000	21,000	.00102	.00004				
22,000	22,000	.00110	.00008				
23,000	23,000	.00114	.00004				
24,000	24,000	.00120	.00006				
25,000	25,000	.00130	.00010	.00016	.00008		
26,000	26,000	.00136	.00006				
27,000	27,000	.00146	.00010				
28,000	28,000	.00158	.00012				
29,000	29,000	.00172	.00014				
30,000	30,000	.00180	.00008	.00042	.00026		
31,000	31,000	.00194	.00014				
32,000	32,000	.00212	.00018				
33,000	33,000	.00236	.00024				
34,000	34,000	.00256	.00020				
35,000	35,000	.00288	.00030	.00126	.00084		
36,000	36,000	.00320	.00034				
37,000	37,000	.00350	.00030				
38,000	38,000	.00390	.00040				
39,000	39,000	.00436	.00048				
40,000	40,000	.00490	.00054	.00302	.00176		
41,000	41,000	.00546	.00056				
42,000	42,000	.00590	.00044				
43,000	43,000	.00648	.00056				
44,000	44,000	.00682	.00036				
45,000	45,000	.00736	.00054	.00518	.00216		
46,000	46,000	.00796	.00060				
47,000	47,000	.00840	.00044				
48,000	48,000	.00886	.00026				
49,000	49,000	.00904	.00038				
50,000	50,000	.00936	.00032	.00704	.00186		
58,500	58,500						Ultimate strength.

Failed by triple flexure.

## BODY No. 12 (third casting).

No. 4600.

Marks, <sup>12 M R, T R,</sup>  
<sub>B T, 11</sub>Diameter, 1<sup>11</sup>/<sub>129</sub>.

Sectional area, 1 square inch.

Length of stem, 23<sup>11</sup>/<sub>16</sub>.Gauged length, 20<sup>11</sup>/<sub>16</sub>.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.000055	.000055			
3,000	3,000	.000105	.000050			
4,000	4,000	.000160	.000055			
5,000	5,000	.000205	.000045	0.		
6,000	6,000	.000255	.000050			
7,000	7,000	.000305	.000050			
8,000	8,000	.000360	.000055			
9,000	9,000	.000420	.000060			
10,000	10,000	.000485	.000065	.000010	.000010	
11,000	11,000	.000540	.000055			
12,000	12,000	.000600	.000060	.000030	.000020	
13,000	13,000	.000660	.000060			
14,000	14,000	.000740	.000080	.000045	.000015	
15,000	15,000	.000810	.000070			
16,000	16,000	.000895	.000085	.000090	.000045	
17,000	17,000	.000990	.000095			
18,000	18,000	.001095	.000105	.000155	.000065	
19,000	19,000	.001205	.000110			
20,000	20,000	.001340	.000135	.000260	.000105	
21,000	21,000	.001485	.000145			
22,000	22,000	.001660	.000175	.000455	.000195	
23,000	23,000	.001900	.000210			
24,000	24,000	.002150	.000250	.000800	.000345	
25,000	25,000	.002550	.000400	.001090	.000290	
28,530	28,530	.....	.....	.....	.....	Tensile strength.

Fractured at middle of stem. Appearance, uniform, granular.

No. 4601.

Marks, <sup>12 M R<sub>12</sub> T B<sub>2</sub></sup>  
<sup>M T<sub>21</sub></sup>  
 Diameter, 1".129.  
 Sectional area, 1 square inch.  
 Length of stem, 23".  
 Gauged length, 20".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.000045	.000045			
3,000	3,000	.000090	.000045			
4,000	4,000	.000140	.000050			
5,000	5,000	.000190	.000050	0.		
6,000	6,000	.000240	.000050			
7,000	7,000	.000290	.000050			
8,000	8,000	.000340	.000050			
9,000	9,000	.000390	.000050			
10,000	10,000	.000445	.000055	0.		
11,000	11,000	.000495	.000050			
12,000	12,000	.000555	.000060	.000015	.000015	
13,000	13,000	.000610	.000055			
14,000	14,000	.000670	.000060	.000035	.000020	
15,000	15,000	.000740	.000070			
16,000	16,000	.000805	.000085	.000055	.000020	
17,000	17,000	.000885	.000080			
18,000	18,000	.000955	.000070	.000055	.000040	
19,000	19,000	.001040	.000085			
20,000	20,000	.001125	.000085	.000145	.000050	
21,000	21,000	.001230	.000105			
22,000	22,000	.001340	.000110	.000245	.000100	
23,000	23,000	.001485	.000145			
24,000	24,000	.001650	.000165	.000415	.000170	
25,000	25,000	.001825	.000175	.000535	.000120	
28,020	28,020					Tensile strength.

Fractured at middle of stem. Appearance, uniform, granular.

No. 1010.

Marks, <sup>12 M R<sub>15</sub> T B<sub>2</sub></sup>  
<sub>B T<sub>2</sub></sub>  
 Length, 13''<sup>5</sup>/<sub>8</sub>.  
 Diameter, 1''<sup>129</sup>/<sub>32</sub>.  
 Sectional area, 1 square inch.  
 Gauged length, 5''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0.	0.	0.		
2,000	2,000	.00008	.00008	.....	.....		
3,000	3,000	.00012	.00004	.....	.....		
4,000	4,000	.00016	.00004	.....	.....		
5,000	5,000	.00024	.00008	0.	.....		
6,000	6,000	.00030	.00006	.....	.....		
7,000	7,000	.00034	.00004	.....	.....		
8,000	8,000	.00038	.00004	.....	.....		
9,000	9,000	.00044	.00006	.....	.....		
10,000	10,000	.00050	.00006	.00004	.00004		
11,000	11,000	.00054	.00004	.....	.....		
12,000	12,000	.00060	.00006	.....	.....		
13,000	13,000	.00066	.00006	.....	.....		
14,000	14,000	.00072	.00006	.....	.....		
15,000	15,000	.00078	.00006	.00006	.00002		
16,000	16,000	.00084	.00006	.....	.....		
17,000	17,000	.00090	.00006	.....	.....		
18,000	18,000	.00096	.00006	.....	.....		
19,000	19,000	.00104	.00008	.....	.....		
20,000	20,000	.00110	.00006	.00016	.00010		
21,000	21,000	.00118	.00008	.....	.....		
22,000	22,000	.00124	.00006	.....	.....		
23,000	23,000	.00134	.00010	.....	.....		
24,000	24,000	.00142	.00008	.....	.....		
25,000	25,000	.00152	.00010	.00034	.00018		
26,000	26,000	.00164	.00012	.....	.....		
27,000	27,000	.00174	.00010	.....	.....		
28,000	28,000	.00188	.00014	.....	.....		
29,000	29,000	.00204	.00016	.....	.....		
30,000	30,000	.00222	.00018	.00008	.00034		
31,000	31,000	.00244	.00022	.....	.....		
32,000	32,000	.00264	.00020	.....	.....		
33,000	33,000	.00288	.00024	.....	.....		
34,000	34,000	.00326	.00038	.....	.....		
35,000	35,000	.00366	.00040	.00176	.00108		
36,000	36,000	.00404	.00038	.....	.....		
37,000	37,000	.00448	.00044	.....	.....		
38,000	38,000	.00492	.00044	.....	.....		
39,000	39,000	.00548	.00056	.....	.....		
40,000	40,000	.00592	.00044	.00376	.00200		
41,000	41,000	.00660	.00068	.....	.....		
42,000	42,000	.00700	.00040	.....	.....		
43,000	53,000	.00750	.00050	.....	.....		
44,000	44,000	.00834	.00084	.....	.....		
45,000	45,000	.00904	.00070	.00660	.00284		
59,060	59,060	.....	.....	.....	.....		Ultimate strength.

Failed by triple flexure.



No. 1011.

Marks,  $12 M R_{12} T R_2$   
 $B R_{20}$   
 Length, 10'' .5.  
 Diameter, 1'' .129.  
 Sectional area, 1 square inch.  
 Gauged length, 5''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0.	0.	0.		
2,000	2,000	.00004	.00004	.....	.....		
3,000	3,000	.00008	.00004	.....	.....		
4,000	4,000	.00014	.00006	.....	.....		
5,000	5,000	.00018	.00004	0.	.....		
6,000	6,000	.00024	.00006	.....	.....		
7,000	7,000	.00028	.00004	.....	.....		
8,000	8,000	.00032	.00004	.....	.....		
9,000	9,000	.00038	.00006	.....	.....		
10,000	10,000	.00044	.00006	.00002	.00002		
11,000	11,000	.00050	.00006	.....	.....		
12,000	12,000	.00054	.00004	.....	.....		
13,000	13,000	.00058	.00004	.....	.....		
14,000	14,000	.00064	.00006	.....	.....		
15,000	15,000	.00070	.00006	.00006	.00004		
16,000	16,000	.00074	.00004	.....	.....		
17,000	17,000	.00080	.00006	.....	.....		
18,000	18,000	.00088	.00008	.....	.....		
19,000	19,000	.00094	.00006	.....	.....		
20,000	20,000	.00102	.00008	.00008	.00002		
21,000	21,000	.00108	.00006	.....	.....		
22,000	22,000	.00114	.00006	.....	.....		
23,000	23,000	.00120	.00006	.....	.....		
24,000	24,000	.00130	.00010	.....	.....		
25,000	25,000	.00138	.00008	.00024	.00016		
26,000	26,000	.00152	.00014	.....	.....		
27,000	27,000	.00164	.00012	.....	.....		
28,000	28,000	.00172	.00008	.....	.....		
29,000	29,000	.00180	.00008	.....	.....		
30,000	30,000	.00196	.00016	.00050	.00026		
31,000	31,000	.00218	.00022	.....	.....		
32,000	32,000	.00256	.00038	.....	.....		
33,000	33,000	.00284	.00028	.....	.....		
34,000	34,000	.00302	.00018	.....	.....		
35,000	35,000	.00324	.00022	.00070	.00020		
36,000	36,000	.00372	.00048	.....	.....		
37,000	37,000	.00414	.00042	.....	.....		
38,000	38,000	.00452	.00038	.....	.....		
39,000	39,000	.00492	.00040	.....	.....		
40,000	40,000	.00564	.00072	.00168	.00098		
41,000	41,000	.00600	.00036	.....	.....		
42,000	42,000	.00640	.00040	.....	.....		
43,000	43,000	.00690	.00050	.....	.....		
44,000	44,000	.00758	.00066	.....	.....		
45,000	45,000	.00808	.00052	.00580	.00412		
46,000	46,000	.00860	.00052	.....	.....		
47,000	47,000	.00890	.00030	.....	.....		
48,000	48,000	.00920	.00030	.....	.....		
49,000	49,000	.00958	.00038	.....	.....		
50,000	50,000	.01004	.00046	.00760	.00180		
58,200	58,200	.....	.....	.....	.....		Ultimate strength.

Failed by triple flexure.

No. 1012.

Marks, <sup>12 M R, T R,</sup>  
<sub>M 1, 2,</sub>  
 Length, 10' 5".  
 Diameter, 1" .129.  
 Sectional area, 1 square inch.  
 Gauged length, 5".

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0.	0.	0.		
2,000	2,000	.00004	.00004				
3,000	3,000	.00010	.00006				
4,000	4,000	.00014	.00004				
5,000	5,000	.00018	.00004	.00002	.00002		
6,000	6,000	.00024	.00006				
7,000	7,000	.00030	.00006				
8,000	8,000	.00034	.00004				
9,000	9,000	.00040	.00006				
10,000	10,000	.00046	.00006	.00004	.00002		
11,000	11,000	.00052	.00006				
12,000	12,000	.00056	.00001				
13,000	13,000	.00060	.00004				
14,000	14,000	.00064	.00004				
15,000	15,000	.00070	.00006	.00004	0.		
16,000	16,000	.00076	.00006				
17,000	17,000	.00080	.00004				
18,000	18,000	.00086	.00006				
19,000	19,000	.00092	.00006				
20,000	20,000	.00096	.00006	.00008	.00004		
21,000	21,000	.00108	.00010				
22,000	22,000	.00114	.00006				
23,000	23,000	.00122	.00008				
24,000	24,000	.00130	.00008				
25,000	25,000	.00136	.00006	.00022	.00014		
26,000	26,000	.00146	.00012				
27,000	27,000	.00154	.00006				
28,000	28,000	.00164	.00010				
29,000	29,000	.00174	.00010				
30,000	30,000	.00188	.00014	.00040	.00018		
31,000	31,000	.00202	.00014				
32,000	32,000	.00216	.00014				
33,000	33,000	.00234	.00018				
34,000	34,000	.00254	.00020				
35,000	35,000	.00280	.00026	.00110	.00070		
36,000	36,000	.00310	.00030				
37,000	37,000	.00330	.00020				
38,000	38,000	.00366	.00056				
39,000	39,000	.00430	.00044				
40,000	40,000	.00480	.00050	.00270	.00160		
41,000	41,000	.00520	.00040				
42,000	42,000	.00560	.00040				
43,000	43,000	.00604	.00044				
44,000	44,000	.00650	.00046				
45,000	45,000	.00694	.00044	.00480	.00210		
46,000	46,000	.00750	.00056				
47,000	47,000	.00792	.00042				
48,000	48,000	.00834	.00042				
49,000	49,000	.00870	.00036				
50,000	50,000	.00910	.00040	.00680	.00200		
58,500	58,500						Ultimate strength.

Failed by triple flexure.

BODY No. 12 (fourth casting).

No. 4626.

Marks, <sup>13 M R<sub>12</sub> T R<sub>6</sub></sup>  
<sub>B T<sub>1</sub></sub>

Diameter, 1".129.

Sectional area 1 square inch.

Length of stem, 23".

Gauged length, 20".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0.	0.	0.		
2,000	2,000	.000055	.000055	-----	-----		
3,000	3,000	.000105	.000050	-----	-----		
4,000	4,000	.000155	.000050	-----	-----		
5,000	5,000	.000210	.000055	0.	-----		
6,000	6,000	.000265	.000055	-----	-----		
7,000	7,000	.000315	.000050	-----	-----		
8,000	8,000	.000370	.000055	-----	-----		
9,000	9,000	.000425	.000055	-----	-----		
10,000	10,000	.000475	.000050	.000015	.000015		
11,000	11,000	.000530	.000055	-----	-----		
12,000	12,000	.000585	.000055	.000025	.000010		
13,000	13,000	.000660	.000075	-----	-----		
14,000	14,000	.000725	.000085	.000060	.000035		
15,000	15,000	.000800	.000075	-----	-----		
16,000	16,000	.000875	.000075	.000080	.000020		
17,000	17,000	.000960	.000085	-----	-----		
18,000	18,000	.001050	.000090	.000135	.000055		
19,000	19,000	.001135	.000095	-----	-----		
20,000	20,000	.001230	.000095	.000200	.000065		
21,000	21,000	.001340	.000110	-----	-----		
22,000	22,000	.001475	.000135	.000315	.000115		
23,000	23,000	.001625	.000150	-----	-----		
24,000	24,000	.001790	.000165	.000525	.000210		
25,000	25,000	.002080	.000200	.000700	.000175		
29,890	29,890	-----	-----	-----	-----		Tensile strength.

Fractured 9".6 from neck. Appearance, granular.

H. Ex. 43—12

No. 4627.

Marks, <sup>12 M R, T R,</sup>  
<sup>M 7<sup>th</sup></sup>  
 Diameter, 1".129.  
 Sectional area, 1 square inch.  
 Length of stem, 23".  
 Gauged length, 20".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.000045	.000045			
3,000	3,000	.000095	.000050			
4,000	4,000	.000145	.000050			
5,000	5,000	.000195	.000050	0.		
6,000	6,000	.000245	.000050			
7,000	7,000	.000295	.000050			
8,000	8,000	.000345	.000050			
9,000	9,000	.000395	.000050			
10,000	10,000	.000450	.000055	.000015	.000015	
11,000	11,000	.000515	.000065			
12,000	12,000	.000570	.000055	.000035	.000020	
13,000	13,000	.000635	.000085			
14,000	14,000	.000695	.000090	.000045	.000010	
15,000	15,000	.000750	.000055			
16,000	16,000	.000820	.000070	.000075	.000030	
17,000	17,000	.000895	.000075			
18,000	18,000	.000955	.000090	.000105	.000030	
19,000	19,000	.001045	.000090			
20,000	20,000	.001135	.000090	.000190	.000065	
21,000	21,000	.001240	.000105			
22,000	22,000	.001340	.000100	.000255	.000095	
23,000	23,000	.001480	.000140			
24,000	24,000	.001600	.000120	.000390	.000135	
25,000	25,000	.001775	.000175	.000500	.000110	
29,250	29,250	-----	-----	-----	-----	Tensile strength.

Fractured  $\frac{3}{4}$ " from neck. Appearance, granular.

No. 1028.

Marks, <sup>12</sup>M R, <sup>11</sup>T R,  
<sub>B 1<sup>m</sup></sub>

Length, 10'.5.

Diameter, 1".129.

Sectional area, 1 square inch.

Gauged length, 5'.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.00004	.00004	.....	.....	
3,000	3,000	.00008	.00004	.....	.....	
4,000	4,000	.00012	.00004	.....	.....	
5,000	5,000	.00016	.00004	0.	.....	
6,000	6,000	.00020	.00004	.....	.....	
7,000	7,000	.00028	.00006	.....	.....	
8,000	8,000	.00030	.00004	.....	.....	
9,000	9,000	.00034	.00004	.....	.....	
10,000	10,000	.00040	.00006	0.	.....	
11,000	11,000	.00044	.00004	.....	.....	
12,000	12,000	.00048	.00004	.....	.....	
13,000	13,000	.00052	.00004	.....	.....	
14,000	14,000	.00058	.00006	.....	.....	
15,000	15,000	.00064	.00006	0.	.....	
16,000	16,000	.00068	.00004	.....	.....	
17,000	17,000	.00072	.00004	.....	.....	
18,000	18,000	.00078	.00006	.....	.....	
19,000	19,000	.00084	.00006	.....	.....	
20,000	20,000	.00092	.00008	.00004	.00004	
21,000	21,000	.00098	.00006	.....	.....	
22,000	22,000	.00104	.00006	.....	.....	
23,000	23,000	.00110	.00006	.....	.....	
24,000	24,000	.00116	.00006	.....	.....	
25,000	25,000	.00124	.00008	.00014	.00010	
26,000	26,000	.00132	.00006	.....	.....	
27,000	27,000	.00142	.00010	.....	.....	
28,000	28,000	.00152	.00010	.....	.....	
29,000	29,000	.00160	.00008	.....	.....	
30,000	30,000	.00172	.00012	.00036	.00022	
31,000	31,000	.00186	.00014	.....	.....	
32,000	32,000	.00208	.00022	.....	.....	
33,000	33,000	.00222	.00014	.....	.....	
34,000	34,000	.00242	.00020	.....	.....	
35,000	35,000	.00272	.00030	.00104	.00068	
36,000	36,000	.00306	.00034	.....	.....	
37,000	37,000	.00338	.00032	.....	.....	
38,000	38,000	.00364	.00046	.....	.....	
39,000	39,000	.00412	.00028	.....	.....	
40,000	40,000	.00456	.00044	.00204	.00160	
41,000	41,000	.00500	.00044	.....	.....	
42,000	42,000	.00548	.00048	.....	.....	
43,000	43,000	.00604	.00056	.....	.....	
44,000	44,000	.00646	.00042	.....	.....	
45,000	45,000	.00712	.00068	.00488	.00224	
46,000	46,000	.00758	.00046	.....	.....	
47,000	47,000	.00806	.00048	.....	.....	
48,000	48,000	.00882	.00076	.....	.....	
49,000	49,000	.00924	.00042	.....	.....	
50,000	50,000	.00980	.00056	.00724	.00236	
64,460	64,460	.....	.....	.....	.....	

Ultimate strength.

Failed by triple flexure.

No. 1029.

Marks, <sup>12 M R<sub>15</sub> T R<sub>2</sub></sup>  
<sub>B R<sub>100</sub></sub>

Length, 10'' .5.

Diameter, 1'' .129.

Sectional area, 1 square inch.

Gauged length, 5''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0.	0.	0.		
2,000	2,000	.00006	.00006	.....	.....		
3,000	3,000	.00012	.00006	.....	.....		
4,000	4,000	.00016	.00004	.....	.....		
5,000	5,000	.00020	.00004	.00002	.00002		
6,000	6,000	.00028	.00006	.....	.....		
7,000	7,000	.00030	.00004	.....	.....		
8,000	8,000	.00034	.00004	.....	.....		
9,000	9,000	.00038	.00004	.....	.....		
10,000	10,000	.00044	.00006	.00001	.00002		
11,000	11,000	.00048	.00004	.....	.....		
12,000	12,000	.00051	.00006	.....	.....		
13,000	13,000	.00058	.00004	.....	.....		
14,000	14,000	.00064	.00006	.....	.....		
15,000	15,000	.00070	.00006	.00006	.00002		
16,000	16,000	.00074	.00004	.....	.....		
17,000	17,000	.00080	.00006	.....	.....		
18,000	18,000	.00086	.00006	.....	.....		
19,000	19,000	.00092	.00006	.....	.....		
20,000	20,000	.00096	.00004	.00012	.00006		
21,000	21,000	.00104	.00008	.....	.....		
22,000	22,000	.00110	.00006	.....	.....		
23,000	23,000	.00114	.00004	.....	.....		
24,000	24,000	.00120	.00006	.....	.....		
25,000	25,000	.00130	.00010	.00020	.00008		
26,000	26,000	.00134	.00004	.....	.....		
27,000	27,000	.00140	.00006	.....	.....		
28,000	28,000	.00150	.00010	.....	.....		
29,000	29,000	.00156	.00006	.....	.....		
30,000	30,000	.00172	.00016	.00036	.00016		
31,000	31,000	.00192	.00020	.....	.....		
32,000	32,000	.00210	.00018	.....	.....		
33,000	33,000	.00236	.00026	.....	.....		
34,000	34,000	.00252	.00016	.....	.....		
35,000	35,000	.00276	.00024	.00114	.00078		
36,000	36,000	.00316	.00040	.....	.....		
37,000	37,000	.00352	.00036	.....	.....		
38,000	38,000	.00384	.00032	.....	.....		
39,000	39,000	.00430	.00046	.....	.....		
40,000	40,000	.00480	.00050	.00290	.00176		
41,000	41,000	.00530	.00050	.....	.....		
42,000	42,000	.00564	.00034	.....	.....		
43,000	43,000	.00600	.00036	.....	.....		
44,000	44,000	.00652	.00052	.....	.....		
45,000	45,000	.00706	.00054	.00486	.00196		
46,000	46,000	.00754	.00048	.....	.....		
47,000	47,000	.00814	.00060	.....	.....		
48,000	48,000	.00868	.00054	.....	.....		
49,000	49,000	.00914	.00046	.....	.....		
50,000	50,000	.00972	.00058	.00722	.00236		
64,170	64,170	.....	.....	.....	.....		Ultimate strength.

Failed by triple flexure.

No. 1030.

Marks, <sup>12</sup>M R<sub>1</sub> T R<sub>1</sub>  
<sup>M</sup><sub>1</sub> <sup>T</sup><sub>1</sub>  
 Length, 10''<sup>1</sup>/<sub>2</sub>.  
 Diameter, 1''<sup>1</sup>/<sub>29</sub>.  
 Sectional area, 1 square inch.  
 Gauged length, 5''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.00004	.00004	.....	.....	
3,000	3,000	.00010	.00008	.....	.....	
4,000	4,000	.00016	.00006	.....	.....	
5,000	5,000	.00020	.00004	0.	.....	
6,000	6,000	.00024	.00004	.....	.....	
7,000	7,000	.00028	.00004	.....	.....	
8,000	8,000	.00032	.00004	.....	.....	
9,000	9,000	.00036	.00004	.....	.....	
10,000	10,000	.00042	.00006	.00002	.00002	
11,000	11,000	.00048	.00006	.....	.....	
12,000	12,000	.00052	.00004	.....	.....	
13,000	13,000	.00056	.00004	.....	.....	
14,000	14,000	.00062	.00006	.....	.....	
15,000	15,000	.00068	.00006	.00006	.00004	
16,000	16,000	.00074	.00006	.....	.....	
17,000	17,000	.00080	.00006	.....	.....	
18,000	18,000	.00086	.00006	.....	.....	
19,000	19,000	.00092	.00006	.....	.....	
20,000	20,000	.00096	.00004	.00010	.00004	
21,000	21,000	.00102	.00006	.....	.....	
22,000	22,000	.00110	.00008	.....	.....	
23,000	23,000	.00116	.00006	.....	.....	
24,000	24,000	.00124	.00008	.....	.....	
25,000	25,000	.00132	.00008	.00020	.00010	
26,000	26,000	.00140	.00008	.....	.....	
27,000	27,000	.00148	.00008	.....	.....	
28,000	28,000	.00158	.00010	.....	.....	
29,000	29,000	.00170	.00012	.....	.....	
30,000	30,000	.00184	.00014	.00044	.00024	
31,000	31,000	.00196	.00012	.....	.....	
32,000	32,000	.00212	.00016	.....	.....	
33,000	33,000	.00232	.00020	.....	.....	
34,000	34,000	.00252	.00020	.....	.....	
35,000	35,000	.00278	.00026	.00116	.00072	
36,000	36,000	.00296	.00018	.....	.....	
37,000	37,000	.00332	.00036	.....	.....	
38,000	38,000	.00368	.00036	.....	.....	
39,000	39,000	.00410	.00042	.....	.....	
40,000	40,000	.00464	.00054	.00270	.00154	
41,000	41,000	.00504	.00040	.....	.....	
42,000	42,000	.00558	.00054	.....	.....	
43,000	43,000	.00596	.00038	.....	.....	
44,000	44,000	.00654	.00058	.....	.....	
45,000	45,000	.00720	.00086	.00498	.00228	
46,000	46,000	.00768	.00048	.....	.....	
47,000	47,000	.00800	.00032	.....	.....	
48,000	48,000	.00856	.00056	.....	.....	
49,000	49,000	.00924	.00068	.....	.....	
50,000	50,000	.00888	.00064	.00734	.00236	
64,220	64,220	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

BODY No. 13.

No. 4596.

Marks, <sup>12 M B<sub>11</sub> T E<sub>1</sub></sup><sub>B T</sub>

Diameter, 1".112.

Sectional area, ".97 square inch.

Length of stem, 23".

Gauged length, 20".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
970	1,000	0.	0.	0.	0.	
1,940	2,000	.000055	.000055	.....	.....	
2,910	3,000	.000095	.000040	.....	.....	
3,880	4,000	.000160	.000065	.....	.....	
4,850	5,000	.000205	.000045	.0	.....	
5,820	6,000	.000265	.000060	.....	.....	
6,790	7,000	.000320	.000055	.....	.....	
7,760	8,000	.000380	.000060	.....	.....	
8,730	9,000	.000435	.000055	.....	.....	
9,700	10,000	.000495	.000060	.000025	.000025	
10,670	11,000	.000555	.000060	.....	.....	
11,640	12,000	.000630	.000075	.000050	.000025	
12,610	13,000	.000690	.000060	.....	.....	
13,580	14,000	.000705	.000075	.000080	.000030	
14,550	15,000	.000840	.000075	.....	.....	
15,520	16,000	.000930	.000090	.000110	.000030	
16,490	17,000	.001010	.000080	.....	.....	
17,460	18,000	.001110	.000100	.000170	.000060	
18,430	19,000	.001210	.000100	.....	.....	
19,400	20,000	.001340	.000130	.000320	.000150	
20,370	21,000	.001470	.000130	.....	.....	
21,340	22,000	.001610	.000140	.000405	.000085	
22,310	23,000	.001800	.000190	.....	.....	
23,280	24,000	.002040	.000240	.000675	.000270	
24,250	25,000	.002330	.000290	.000875	.000200	
						Tensile strength.

Fractured 6".9 from neck. Appearance, uniform, granular.



No. 4597.

Marks, <sup>13 M R<sub>11</sub> T E<sub>1</sub></sup>  
<sub>M T<sub>1</sub></sub>

Diameter, 1".129.

Sectional area, 1 square inch.

Length of stem, 23".

Gauged length, 20".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.000050	.000050	.....	.....	
3,000	3,000	.000100	.000050	.....	.....	
4,000	4,000	.000145	.000045	.....	.....	
5,000	5,000	.000195	.000050	0.	.....	
6,000	6,000	.000250	.000055	.....	.....	
7,000	7,000	.000305	.000055	.....	.....	
8,000	8,000	.000360	.000055	.....	.....	
9,000	9,000	.000410	.000050	.....	.....	
10,000	16,000	.000470	.000060	.000015	.000015	
11,000	11,000	.000520	.000050	.....	.....	
12,000	12,000	.000580	.000060	.000035	.000020	
13,000	13,000	.000640	.000060	.....	.....	
14,000	14,000	.000705	.000065	.000040	.000005	
15,000	15,000	.000770	.000065	.....	.....	
16,000	16,000	.000845	.000075	.000060	.000020	
17,000	17,000	.000910	.000065	.....	.....	
18,000	18,000	.000985	.000075	.000095	.000035	
19,000	19,000	.001100	.000115	.....	.....	
20,000	20,000	.001225	.000125	.000195	.000100	
20,840	20,840	.....	.....	.....	.....	Tensile strength.

Fractured at middle of stem. Appearance, granular, with coarse dark spangles.

No. 1004.

Marks, <sup>12 M P<sub>13</sub> T E<sub>2</sub></sup>  
<sub>B T<sub>2</sub></sub>  
 Length, 10''<sup>5</sup>.  
 Diameter, 1''<sup>.129</sup>.  
 Sectional area, 1 square inch.  
 Gauged length, 5''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0.	0.	0.		
2,000	2,000	.00004	.00004	.....	.....		
3,000	3,000	.00010	.00006	.....	.....		
4,000	4,000	.00014	.00004	.....	.....		
5,000	5,000	.00020	.00006	.00004	.00004		
6,000	6,000	.00026	.00006	.....	.....		
7,000	7,000	.00032	.00006	.....	.....		
8,000	8,000	.00036	.00004	.....	.....		
9,000	9,000	.00042	.00006	.....	.....		
10,000	10,000	.00046	.00004	.00004	0.		
11,000	11,000	.00052	.00006	.....	.....		
12,000	12,000	.00060	.00008	.....	.....		
13,000	13,000	.00064	.00004	.....	.....		
14,000	14,000	.00070	.00006	.....	.....		
15,000	15,000	.00074	.00004	.00012	.00008		
16,000	16,000	.00078	.00004	.....	.....		
17,000	17,000	.00086	.00008	.....	.....		
18,000	18,000	.00092	.00006	.....	.....		
19,000	19,000	.00096	.00004	.....	.....		
20,000	20,000	.00102	.00006	.00016	.00004		
21,000	21,000	.00110	.00008	.....	.....		
22,000	22,000	.00116	.00006	.....	.....		
23,000	23,000	.00124	.00008	.....	.....		
24,000	24,000	.00130	.00006	.....	.....		
25,000	25,000	.00138	.00008	.00022	.00006		
26,000	26,000	.00150	.00012	.....	.....		
27,000	27,000	.00158	.00008	.....	.....		
28,000	28,000	.00168	.00010	.....	.....		
29,000	29,000	.00172	.00004	.....	.....		
30,000	30,000	.00184	.00012	.00050	.00028		
31,000	31,000	.00202	.00018	.....	.....		
32,000	32,000	.00216	.00014	.....	.....		
33,000	33,000	.00230	.00014	.....	.....		
34,000	34,000	.00258	.00028	.....	.....		
35,000	35,000	.00288	.00030	.00104	.00054		
36,000	36,000	.00320	.00032	.....	.....		
37,000	37,000	.00348	.00028	.....	.....		
38,000	38,000	.00388	.00040	.....	.....		
39,000	39,000	.00428	.00040	.....	.....		
40,000	40,000	.00468	.00040	.00288	.00184		
41,000	41,000	.00534	.00050	.....	.....		
42,000	42,000	.00580	.00046	.....	.....		
43,000	43,000	.00650	.00070	.....	.....		
44,000	44,000	.00710	.00060	.....	.....		
45,000	45,000	.00776	.00066	.00540	.00252		
46,000	46,000	.00854	.00078	.....	.....		
47,000	47,000	.00930	.00076	.....	.....		
48,000	48,000	.01018	.00088	.....	.....		
49,000	49,000	.01094	.00076	.....	.....		
50,000	50,000	.01176	.00082	.00938	.00398		
59,780	59,780	.....	.....	.....	.....		Ultimate strength.

Failed by triple flexure.

No. 1005.

Marks, <sup>12</sup>M R<sub>10</sub> T R<sub>10</sub>  
 Length, 10''<sup>5</sup>.  
 Diameter, 1''<sup>129</sup>.  
 Sectional area, 1 square inch.  
 Gauged length, 5''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.00006	.00006	.....	.....	
3,000	3,000	.00012	.00008	.....	.....	
4,000	4,000	.00016	.00004	.....	.....	
5,000	5,000	.00020	.00004	0.	.....	
6,000	6,000	.00026	.00006	.....	.....	
7,000	7,000	.00032	.00006	.....	.....	
8,000	8,000	.00036	.00004	.....	.....	
9,000	9,000	.00040	.00004	.....	.....	
10,000	10,000	.00046	.00006	0.	.....	
11,000	11,000	.00054	.00008	.....	.....	
12,000	12,000	.00058	.00004	.....	.....	
13,000	13,000	.00062	.00004	.....	.....	
14,000	14,000	.00070	.00008	.....	.....	
15,000	15,000	.00074	.00004	.00006	.00006	
16,000	16,000	.00080	.00006	.....	.....	
17,000	17,000	.00086	.00006	.....	.....	
18,000	18,000	.00090	.00004	.....	.....	
19,000	19,000	.00096	.00006	.....	.....	
20,000	20,000	.00102	.00006	.00012	.00006	
21,000	21,000	.00110	.00008	.....	.....	
22,000	22,000	.00118	.00008	.....	.....	
23,000	23,000	.00124	.00006	.....	.....	
24,000	24,000	.00132	.00008	.....	.....	
25,000	25,000	.00138	.00006	.00022	.00010	
26,000	26,000	.00148	.00010	.....	.....	
27,000	27,000	.00154	.00006	.....	.....	
28,000	28,000	.00162	.00008	.....	.....	
29,000	29,000	.00172	.00010	.....	.....	
30,000	30,000	.00184	.00012	.00044	.00022	
31,000	31,000	.00204	.00020	.....	.....	
32,000	32,000	.00220	.00016	.....	.....	
33,000	33,000	.00244	.00024	.....	.....	
34,000	34,000	.00264	.00020	.....	.....	
35,000	35,000	.00294	.00030	.00130	.00086	
36,000	36,000	.00328	.00034	.....	.....	
37,000	37,000	.00358	.00030	.....	.....	
38,000	38,000	.00398	.00040	.....	.....	
39,000	39,000	.00444	.00046	.....	.....	
40,000	40,000	.00474	.00030	.00300	.00170	
41,000	41,000	.00532	.00058	.....	.....	
42,000	42,000	.00586	.00054	.....	.....	
43,000	43,000	.00634	.00048	.....	.....	
44,000	44,000	.00676	.00042	.....	.....	
45,000	45,000	.00726	.00060	.00510	.00210	
46,000	46,000	.00788	.00060	.....	.....	
47,000	47,000	.00820	.00034	.....	.....	
48,000	48,000	.00854	.00034	.....	.....	
49,000	49,000	.00886	.00032	.....	.....	
50,000	50,000	.00908	.00022	.00670	.00160	
59,580	59,580	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

No. 1006.

Marks, <sup>12 M R<sub>11</sub> T R<sub>1</sub></sup>  
<sup>M T<sub>2</sub></sup>  
 Length, 10'' .5.  
 Diameter, 1'' .129.  
 Sectional area, 1 square inch.  
 Gauged length, 5''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
0.	0.	0.	0.	0.	0.	
1,000	1,000	.00006	.00006			
2,000	2,000	.00010	.00004			
3,000	3,000	.00016	.00006			
4,000	4,000	.00020	.00004	0.		
5,000	5,000	.00024	.00004			
6,000	6,000	.00028	.00006			
7,000	7,000	.00034	.00004			
8,000	8,000	.00038	.00004			
9,000	9,000	.00044	.00006	0.		
10,000	10,000	.00050	.00006			
11,000	11,000	.00056	.00006			
12,000	12,000	.00062	.00006			
13,000	13,000	.00068	.00006			
14,000	14,000	.00074	.00006			
15,000	15,000	.00078	.00006	.00004	.00004	
16,000	16,000	.00080	.00004			
17,000	17,000	.00088	.00006			
18,000	18,000	.00094	.00006			
19,000	19,000	.00100	.00006			
20,000	20,000	.00108	.00008	.00012	.00008	
21,000	21,000	.00118	.00010			
22,000	22,000	.00124	.00006			
23,000	23,000	.00134	.00010			
24,000	24,000	.00140	.00008			
25,000	25,000	.00152	.00012	.00028	.00016	
26,000	26,000	.00164	.00012			
27,000	27,000	.00174	.00010			
28,000	28,000	.00186	.00012			
29,000	29,000	.00202	.00016			
30,000	30,000	.00222	.00020	.00072	.00044	
31,000	31,000	.00252	.00030			
32,000	32,000	.00270	.00018			
33,000	33,000	.00290	.00020			
34,000	34,000	.00318	.00028			
35,000	35,000	.00366	.00048	.00186	.00114	
36,000	36,000	.00420	.00054			
37,000	37,000	.00480	.00060			
38,000	38,000	.00510	.00030			
39,000	39,000	.00560	.00050			
40,000	40,000	.00614	.00064	.00406	.00220	
41,000	41,000	.00680	.00066			
42,000	42,000	.00750	.00070			
43,000	43,000	.00834	.00084			
44,000	44,000	.00880	.00046			
45,000	45,000	.01048	.00068	.00780	.00384	
46,000	46,000	.01116	.00068			
47,000	47,000	.01200	.00084			
48,000	48,000	.01340	.00140			
49,000	49,000	.01466	.00126			
50,000	50,000	.01630	.00164	.01310	.00520	
55,000	55,000					Ultimate strength.

Failed by triple flexure.

BODY No. 13 (second casting).

No. 4660.

Marks, <sup>13 M R<sub>12</sub> T B<sub>2</sub></sup>  
<sub>B T<sub>11</sub></sub>

Diameter, 1".129.

Sectional area, 1 square inch.

Length of stem, 23".

Gauged length, 20".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.000050	.000050	-----	-----	
3,000	3,000	.000100	.000050	-----	-----	
4,000	4,000	.000155	.000055	-----	-----	
5,000	5,000	.000205	.000050	.000010	.000010	
6,000	6,000	.000255	.000050	-----	-----	
7,000	7,000	.000315	.000060	-----	-----	
8,000	8,000	.000365	.000050	-----	-----	
9,000	9,000	.000430	.000065	-----	-----	
10,000	10,000	.000490	.000060	.000025	.000015	
11,000	11,000	.000555	.000065	-----	-----	
12,000	12,000	.000615	.000060	.000045	.000020	
13,000	13,000	.000680	.000065	-----	-----	
14,000	14,000	.000755	.000075	.000065	.000020	
15,000	15,000	.000845	.000090	-----	-----	
16,000	16,000	.000920	.000075	.000110	.000045	
17,000	17,000	.001010	.000090	-----	-----	
18,000	18,000	.001100	.000090	.000185	.000075	
19,000	19,000	.001215	.000115	-----	-----	
20,000	20,000	.001335	.000120	.000215	.000090	
21,000	21,000	.001460	.000125	-----	-----	
22,000	22,000	.001600	.000140	.000400	.000185	
23,000	23,000	.001825	.000225	-----	-----	
24,000	24,000	.002050	.000225	.000690	.000290	
25,000	25,000	.002310	.000260	.000885	.000195	
26,620	26,620	-----	-----	-----	-----	Tensile strength.

Fractured 4".5 from neck. Appearance, granular.

No. 4661.

Marks, <sup>12 M R, T R,</sup>  
<sub>M T,</sub>  
 Diameter, 1".129.  
 Sectional area, 1 square inch.  
 Length of stem, 23".  
 Gauged length, 20".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.000050	.000050			
3,000	3,000	.000100	.000050			
4,000	4,000	.000150	.000050			
5,000	5,000	.000200	.000050	.000010	.000010	
6,000	6,000	.000250	.000050			
7,000	7,000	.000305	.000055			
8,000	8,000	.000355	.000050			
9,000	9,000	.000405	.000050			
10,000	10,000	.000460	.000055	.000040	.000030	
11,000	11,000	.000510	.000050			
12,000	12,000	.000560	.000050	.000045	.000025	
13,000	13,000	.000630	.000070			
14,000	14,000	.000695	.000065	.000060	.000015	
15,000	15,000	.000750	.000055			
16,000	16,000	.000810	.000060	.000060	.000030	
17,000	17,000	.000880	.000070			
18,000	18,000	.000950	.000070	.000105	.000015	
19,000	19,000	.001020	.000070			
20,000	20,000	.001100	.000080	.000150	.000045	
21,000	21,000	.001180	.000080			
22,000	22,000	.001265	.000085	.000210	.000060	
23,000	23,000	.001380	.000115			
24,000	24,000	.001495	.000115	.000300	.000060	
25,000	25,000	.001680	.000185	.000425	.000125	
28,450	28,450					Tensile strength.

Fractured ".45 from neck. Appearance, granular; coarse stellar arrangement on one side of fracture.

No. 1031.

Marks, <sup>12 M R<sub>11</sub> T R<sub>2</sub></sup>  
<sup>H T<sub>12</sub></sup>  
 Length, 10''<sup>12</sup>.5.  
 Diameter, 1''<sup>120</sup>.  
 Sectional area, 1 square inch.  
 Gauged length, 5''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.00004	.00004	.....	.....	
3,000	3,000	.00008	.00004	.....	.....	
4,000	4,000	.00012	.00004	.....	.....	
5,000	5,000	.00016	.00004	0.	.....	
6,000	6,000	.00022	.00006	.....	.....	
7,000	7,000	.00026	.00004	.....	.....	
8,000	8,000	.00032	.00006	.....	.....	
9,000	9,000	.00036	.00004	.....	.....	
10,000	10,000	.00042	.00006	0.	.....	
11,000	11,000	.00046	.00004	.....	.....	
12,000	12,000	.00052	.00006	.....	.....	
13,000	13,000	.00056	.00004	.....	.....	
14,000	14,000	.00062	.00006	.....	.....	
15,000	15,000	.00068	.00006	.00002	.00002	
16,000	16,000	.00072	.00004	.....	.....	
17,000	17,000	.00078	.00006	.....	.....	
18,000	18,000	.00084	.00006	.....	.....	
19,000	19,000	.00090	.00006	.....	.....	
20,000	20,000	.00096	.00006	.00010	.00008	
21,000	21,000	.00104	.00008	.....	.....	
22,000	22,000	.00110	.00006	.....	.....	
23,000	23,000	.00118	.00008	.....	.....	
24,000	24,000	.00124	.00006	.....	.....	
25,000	25,000	.00132	.00008	.00020	.00010	
26,000	26,000	.00142	.00010	.....	.....	
27,000	27,000	.00152	.00010	.....	.....	
28,000	28,000	.00160	.00008	.....	.....	
29,000	29,000	.00172	.00012	.....	.....	
30,000	30,000	.00184	.00012	.00044	.00024	
31,000	31,000	.00200	.00016	.....	.....	
32,000	32,000	.00214	.00014	.....	.....	
33,000	33,000	.00232	.00018	.....	.....	
34,000	34,000	.00252	.00020	.....	.....	
35,000	35,000	.00286	.00034	.00120	.00076	
36,000	36,000	.00326	.00040	.....	.....	
37,000	37,000	.00356	.00030	.....	.....	
38,000	38,000	.00388	.00032	.....	.....	
39,000	39,000	.00434	.00046	.....	.....	
40,000	40,000	.00488	.00064	.00290	.00170	
41,000	41,000	.00532	.00044	.....	.....	
42,000	42,000	.00570	.00038	.....	.....	
43,000	43,000	.00626	.00056	.....	.....	
44,000	44,000	.00690	.00064	.....	.....	
45,000	45,000	.00748	.00058	.00516	.00226	
46,000	46,000	.00796	.00048	.....	.....	
47,000	47,000	.00836	.00040	.....	.....	
48,000	48,000	.00900	.00064	.....	.....	
49,000	49,000	.00972	.00072	.....	.....	
50,000	50,000	.01044	.00072	.00780	.00264	
61,500	61,500	.....	.....	.....	.....	

Ultimate strength.

Failed by triple flexure.

No. 1032.

Marks, 12 M R, T R,

B R,

Length, 10<sup>1</sup>/<sub>2</sub>.Diameter, 1<sup>1</sup>/<sub>2</sub>.129.

Sectional area, 1 square inch.

Gauged length, 5<sup>1</sup>/<sub>2</sub>.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0.	0.	0.		
2,000	2,000	.00004	.00004				
3,000	3,000	.00008	.00004				
4,000	4,000	.00012	.00004				
5,000	5,000	.00016	.00004	0.			
6,000	6,000	.00022	.00006				
7,000	7,000	.00028	.00004				
8,000	8,000	.00030	.00004				
9,000	9,000	.00036	.00006				
10,000	10,000	.00042	.00006	0.			
11,000	11,000	.00048	.00006				
12,000	12,000	.00052	.00004				
13,000	13,000	.00058	.00006				
14,000	14,000	.00064	.00006				
15,000	15,000	.00070	.00006	.00004	.00004		
16,000	16,000	.00074	.00004				
17,000	17,000	.00078	.00004				
18,000	18,000	.00084	.00006				
19,000	19,000	.00092	.00008				
20,000	20,000	.00098	.00006	.00008	.00004		
21,000	21,000	.00104	.00006				
22,000	22,000	.00110	.00006				
23,000	23,000	.00118	.00008				
24,000	24,000	.00124	.00006				
25,000	25,000	.00132	.00008	.00020	.00012		
26,000	26,000	.00140	.00008				
27,000	27,000	.00150	.00010				
28,000	28,000	.00160	.00010				
29,000	29,000	.00170	.00010				
30,000	30,000	.00182	.00012	.00044	.00024		
31,000	31,000	.00200	.00018				
32,000	32,000	.00216	.00016				
33,000	33,000	.00234	.00018				
34,000	34,000	.00258	.00024				
35,000	35,000	.00292	.00034	.00124	.00080		
36,000	36,000	.00326	.00044				
37,000	37,000	.00358	.00022				
38,000	38,000	.00388	.00030				
39,000	39,000	.00436	.00048				
40,000	40,000	.00486	.00050	.00290	.00186		
41,000	41,000	.00550	.00064				
42,000	42,000	.00592	.00042				
43,000	43,000	.00648	.00056				
44,000	44,000	.00712	.00064				
45,000	45,000	.00782	.00070	.00548	.00258		
46,000	46,000	.00830	.00048				
47,000	47,000	.00872	.00042				
48,000	48,000	.00936	.00064				
49,000	49,000	.01026	.00090				
50,000	50,000	.01100	.00074	.00634	.00286		
62,800	62,800						Ultimate strength.

Failed by triple flexure.



No. 1033.

Marks, <sup>12</sup>M R, <sup>11</sup>T R,

Length, 10' <sup>1</sup>/<sub>2</sub>.

Diameter, 1" <sup>1</sup>/<sub>2</sub>.129.

Sectional area, 1 square inch.

Gauged length, 5'.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0.	0.	0.		
2,000	2,000	.00004	.00004	.....	.....		
3,000	3,000	.00010	.00008	.....	.....		
4,000	4,000	.00014	.00004	.....	.....		
5,000	5,000	.00018	.00004	0.	.....		
6,000	6,000	.00022	.00004	.....	.....		
7,000	7,000	.00026	.00004	.....	.....		
8,000	8,000	.00032	.00006	.....	.....		
9,000	9,000	.00038	.00008	.....	.....		
10,000	10,000	.00044	.00008	.00002	.00002		
11,000	11,000	.00048	.00004	.....	.....		
12,000	12,000	.00052	.00004	.....	.....		
13,000	13,000	.00056	.00006	.....	.....		
14,000	14,000	.00062	.00006	.....	.....		
15,000	15,000	.00068	.00008	.00004	.00002		
16,000	16,000	.00074	.00008	.....	.....		
17,000	17,000	.00080	.00008	.....	.....		
18,000	18,000	.00086	.00008	.....	.....		
19,000	19,000	.00092	.00008	.....	.....		
20,000	20,000	.00098	.00008	.00008	.00004		
21,000	21,000	.00104	.00008	.....	.....		
22,000	22,000	.00110	.00008	.....	.....		
23,000	23,000	.00116	.00008	.....	.....		
24,000	24,000	.00122	.00008	.....	.....		
25,000	25,000	.00130	.00008	.00014	.00006		
26,000	26,000	.00138	.00008	.....	.....		
27,000	27,000	.00146	.00008	.....	.....		
28,000	28,000	.00154	.00008	.....	.....		
29,000	29,000	.00164	.00010	.....	.....		
30,000	30,000	.00174	.00010	.00032	.00018		
31,000	31,000	.00184	.00010	.....	.....		
32,000	32,000	.00198	.00014	.....	.....		
33,000	33,000	.00214	.00016	.....	.....		
34,000	34,000	.00234	.00020	.....	.....		
35,000	35,000	.00250	.00016	.00080	.00048		
36,000	36,000	.00276	.00026	.....	.....		
37,000	37,000	.00296	.00020	.....	.....		
38,000	38,000	.00324	.00028	.....	.....		
39,000	39,000	.00356	.00032	.....	.....		
40,000	40,000	.00398	.00042	.00200	.00120		
41,000	41,000	.00446	.00048	.....	.....		
42,000	42,000	.00476	.00030	.....	.....		
43,000	43,000	.00514	.00038	.....	.....		
44,000	44,000	.00556	.00042	.....	.....		
45,000	45,000	.00608	.00052	.00382	.00182		
46,000	46,000	.00650	.00042	.....	.....		
47,000	47,000	.00688	.00038	.....	.....		
48,000	48,000	.00724	.00036	.....	.....		
49,000	49,000	.00758	.00034	.....	.....		
50,000	50,000	.00782	.00024	.00540	.00158		
62,580	62,580	.....	.....	.....	.....		Ultimate strength.

Failed by triple flexure.

BODY NO. 13. (Extra disk from second casting.)

No. 4670.

Marks, <sup>12</sup>M R<sub>12</sub> T R<sub>2</sub>  
<sub>B T<sub>11</sub></sub>

Diameter, 1".129.

Sectional area, 1 square inch.

Length of stem, 23".

Gauged length, 20".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.000055	.000055	.....	.....	
3,000	3,000	.000105	.000050	.....	.....	
4,000	4,000	.000160	.000055	.....	.....	
5,000	5,000	.000210	.000050	.000015	.000015	
6,000	6,000	.000270	.000060	.....	.....	
7,000	7,000	.000335	.000065	.....	.....	
8,000	8,000	.000395	.000060	.....	.....	
9,000	9,000	.000450	.000055	.....	.....	
10,000	10,000	.000505	.000055	.000040	.000025	
11,000	11,000	.000575	.000070	.....	.....	
12,000	12,000	.000640	.000065	.000055	.000015	
13,000	13,000	.000705	.000065	.....	.....	
14,000	14,000	.000775	.000070	.000090	.000045	
15,000	15,000	.000850	.000075	.....	.....	
16,000	16,000	.000940	.000090	.000115	.000025	
17,000	17,000	.001025	.000085	.....	.....	
18,000	18,000	.001110	.000085	.000160	.000045	
19,000	19,000	.001215	.000105	.....	.....	
20,000	20,000	.001345	.000130	.000255	.000095	
21,000	21,000	.001455	.000110	.....	.....	
22,000	22,000	.001600	.000145	.000300	.000105	
23,000	23,000	.001785	.000185	.....	.....	
24,000	24,000	.001955	.000170	.000595	.000235	
25,000	25,000	.002210	.000255	.000750	.000155	
28,100	28,100	.....	.....	.....	.....	Tensile strength.

Fractured 2".9 from neck. Appearance, granular.

No. 1040.

Marks, <sup>12 M R<sub>1</sub> T R<sub>2</sub></sup>  
<sub>B T<sub>1</sub></sub>  
 Length, 10''<sup>5</sup>/<sub>8</sub>.  
 Diameter, 1''<sup>1</sup>/<sub>129</sub>.  
 Sectional area, 1 square inch.  
 Gauged length, 5''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0.	0.	0.		
2,000	2,000	.00006	.00006	.....	.....		
3,000	3,000	.00010	.00004	.....	.....		
4,000	4,000	.00014	.00004	.....	.....		
5,000	5,000	.00018	.00004	0.	.....		
6,000	6,000	.00024	.00006	.....	.....		
7,000	7,000	.00028	.00004	.....	.....		
8,000	8,000	.00032	.00004	.....	.....		
9,000	9,000	.00038	.00006	.....	.....		
10,000	10,000	.00044	.00006	.00002	.00002		
11,000	11,000	.00050	.00006	.....	.....		
12,000	12,000	.00054	.00004	.....	.....		
13,000	13,000	.00060	.00006	.....	.....		
14,000	14,000	.00064	.00004	.....	.....		
15,000	15,000	.00072	.00008	.00004	.00002		
16,000	16,000	.00076	.00004	.....	.....		
17,000	17,000	.00082	.00006	.....	.....		
18,000	18,000	.00088	.00006	.....	.....		
19,000	19,000	.00096	.00008	.....	.....		
20,000	20,000	.00102	.00008	.00008	.00004		
21,000	21,000	.00108	.00006	.....	.....		
22,000	22,000	.00114	.00006	.....	.....		
23,000	23,000	.00122	.00008	.....	.....		
24,000	24,000	.00130	.00008	.....	.....		
25,000	25,000	.00138	.00006	.00018	.00010		
26,000	26,000	.00144	.00008	.....	.....		
27,000	27,000	.00152	.00008	.....	.....		
28,000	28,000	.00160	.00008	.....	.....		
29,000	29,000	.00170	.00010	.....	.....		
30,000	30,000	.00184	.00014	.00040	.00022		
31,000	31,000	.00196	.00012	.....	.....		
32,000	32,000	.00208	.00012	.....	.....		
33,000	33,000	.00222	.00014	.....	.....		
34,000	34,000	.00242	.00020	.....	.....		
35,000	35,000	.00270	.00028	.00006	.00006		
36,000	36,000	.00290	.00020	.....	.....		
37,000	37,000	.00312	.00022	.....	.....		
38,000	38,000	.00348	.00036	.....	.....		
39,000	39,000	.00386	.00038	.....	.....		
40,000	40,000	.00428	.00042	.00200	.00134		
41,000	41,000	.00470	.00042	.....	.....		
42,000	42,000	.00508	.00038	.....	.....		
43,000	43,000	.00558	.00050	.....	.....		
44,000	44,000	.00616	.00058	.....	.....		
45,000	45,000	.00684	.00038	.00426	.00196		
46,000	46,000	.00708	.00054	.....	.....		
47,000	47,000	.00752	.00044	.....	.....		
48,000	48,000	.00810	.00058	.....	.....		
49,000	49,000	.00850	.00040	.....	.....		
50,000	50,000	.00932	.00082	.00670	.00244		
65,480	65,480	.....	.....	.....	.....		Ultimate strength.

Failed by triple-flexure.

H. Ex. 43—13

No. 1041.

Marks, <sup>12</sup>M R<sub>1</sub> T R<sub>2</sub>  
B R<sub>20</sub>

Length, 10''<sup>5</sup>/<sub>8</sub>.

Diameter, 1''<sup>129</sup>/<sub>32</sub>.

Sectional area, 1 square inch.

Gauged length, 5''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0.	0.	0.		
2,000	2,000	.00004	.00004	.....	.....		
3,000	3,000	.00010	.00006	.....	.....		
4,000	4,000	.00014	.00004	.....	.....		
5,000	5,000	.00020	.00006	.00002	.00002		
6,000	6,000	.00026	.00006	.....	.....		
7,000	7,000	.00030	.00004	.....	.....		
8,000	8,000	.00034	.00004	.....	.....		
9,000	9,000	.00040	.00006	.....	.....		
10,000	10,000	.00046	.00006	.00004	.00002		
11,000	11,000	.00050	.00004	.....	.....		
12,000	12,000	.00056	.00006	.....	.....		
13,000	13,000	.00060	.00004	.....	.....		
14,000	14,000	.00066	.00006	.....	.....		
15,000	15,000	.00072	.00006	.00008	.00004		
16,000	16,000	.00078	.00006	.....	.....		
17,000	17,000	.00084	.00006	.....	.....		
18,000	18,000	.00090	.00008	.....	.....		
19,000	19,000	.00096	.00006	.....	.....		
20,000	20,000	.00102	.00006	.00014	.00006		
21,000	21,000	.00108	.00006	.....	.....		
22,000	22,000	.00114	.00006	.....	.....		
23,000	23,000	.00122	.00008	.....	.....		
24,000	24,000	.00130	.00008	.....	.....		
25,000	25,000	.00138	.00008	.00028	.00014		
26,000	26,000	.00146	.00008	.....	.....		
27,000	27,000	.00152	.00006	.....	.....		
28,000	28,000	.00162	.00010	.....	.....		
29,000	29,000	.00172	.00010	.....	.....		
30,000	30,000	.00188	.00016	.00050	.00022		
31,000	31,000	.00204	.00016	.....	.....		
32,000	32,000	.00216	.00012	.....	.....		
33,000	33,000	.00232	.00016	.....	.....		
34,000	34,000	.00252	.00020	.....	.....		
35,000	35,000	.00282	.00030	.00116	.00066		
36,000	36,000	.00298	.00026	.....	.....		
37,000	37,000	.00334	.00026	.....	.....		
38,000	38,000	.00368	.00034	.....	.....		
39,000	39,000	.00412	.00044	.....	.....		
40,000	40,000	.00468	.00056	.00272	.00156		
41,000	41,000	.00512	.00044	.....	.....		
42,000	42,000	.00550	.00038	.....	.....		
43,000	43,000	.00604	.00054	.....	.....		
44,000	44,000	.00636	.00032	.....	.....		
45,000	45,000	.00684	.00058	.00472	.00200		
46,000	46,000	.00746	.00052	.....	.....		
47,000	47,000	.00784	.00038	.....	.....		
48,000	48,000	.00848	.00064	.....	.....		
49,000	49,000	.00908	.00060	.....	.....		
50,000	50,000	.00962	.00054	.00710	.00238		
64,460	64,460	.....	.....	.....	.....		Ultimate strength.

Failed by triple flexure

BODY No. 14.

No. 4593.

Marks, <sup>12 M R, H T R,</sup>  
B L

Diameter, 1<sup>11</sup>/<sub>16</sub>.129.

Sectional area, 1 square inch.

Length of stem, 23<sup>11</sup>/<sub>16</sub>.

Gauged length, 20<sup>11</sup>/<sub>16</sub>.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.000050	.000050			
3,000	3,000	.000105	.000105			
4,000	4,000	.000185	.000185			
5,000	5,000	.000230	.000230	0.		
6,000	6,000	.000290	.000290			
7,000	7,000	.000345	.000345			
8,000	8,000	.000405	.000405			
9,000	9,000	.000480	.000480			
10,000	10,000	.000525	.000525	.000025	.000025	
11,000	11,000	.000595	.000570			
12,000	12,000	.000665	.000670	.000045	.000020	
13,000	13,000	.000740	.000675			
14,000	14,000	.000825	.000685	.000075	.000030	
15,000	15,000	.000900	.000675			
16,000	16,000	.000990	.000690	.000105	.000035	
17,000	17,000	.001085	.000695			
18,000	18,000	.001200	.000715	.000185	.000080	
19,000	19,000	.001325	.000725			
20,000	20,000	.001450	.000725	.000300	.000115	
21,000	21,000	.001610	.000760			
22,000	22,000	.001800	.000790	.000500	.000200	
23,000	23,000	.002125	.000825			
24,000	24,000	.002350	.000825	.000850	.000350	
28,160	28,160					Tensile strength.

Fractured at middle of stem. Appearance, uniform, granular.

No. 4599.

Marks, <sup>12 M R<sub>14</sub> T B<sub>1</sub></sup>  
<sub>M T<sub>1</sub></sub>

Diameter, 1".129.

Sectional area, 1 square inch.

Length of stem, 23".

Gauged length, 20".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.000055	.000055	-----	-----	
3,000	3,000	.000105	.000050	-----	-----	
4,000	4,000	.000150	.000045	-----	-----	
5,000	5,000	.000200	.000050	0.	-----	
6,000	6,000	.000260	.000060	-----	-----	
7,000	7,000	.000325	.000065	-----	-----	
8,000	8,000	.000385	.000080	-----	-----	
9,000	9,000	.000440	.000055	-----	-----	
10,000	10,000	.000495	.000055	.000040	.000040	
11,000	11,000	.000555	.000060	-----	-----	
12,000	12,000	.000610	.000055	.000050	.000010	
13,000	13,000	.000670	.000060	-----	-----	
14,000	14,000	.000740	.000070	.000080	.000030	
15,000	15,000	.000810	.000070	-----	-----	
16,000	16,000	.000885	.000075	.000100	.000020	
17,000	17,000	.000965	.000080	-----	-----	
18,000	18,000	.001000	.000095	.000100	.000060	
19,000	19,000	.001150	.000090	-----	-----	
20,000	20,000	.001275	.000125	.000250	.000090	
21,000	21,000	.001400	.000125	-----	-----	
22,000	22,000	.001550	.000150	.000475	.000125	
23,000	23,000	.001740	.000190	-----	-----	
24,000	24,000	.001915	.000175	.000610	.000235	
25,000	25,000	.002240	.000325	.000850	.000240	
25,020	25,020	-----	-----	-----	-----	Tensile strength.

Fractured at middle of stem. Appearance, granular.

No. 1007.

Marks,  $12 M R_{14} T B_2$   
 $B T_2$ Length, 10'' $\frac{5}{8}$ .Diameter, 1'' $\frac{129}{16}$ .

Sectional area, 1 square inch.

Gauged length, 5''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.00008	.00008	.....	.....	
3,000	3,000	.00014	.00008	.....	.....	
4,000	4,000	.00020	.00008	.....	.....	
5,000	5,000	.00028	.00008	.00002	.00002	
6,000	6,000	.00034	.00008	.....	.....	
7,000	7,000	.00038	.00004	.....	.....	
8,000	8,000	.00042	.00004	.....	.....	
9,000	9,000	.00050	.00008	.....	.....	
10,000	10,000	.00054	.00004	.00008	.00008	
11,000	11,000	.00060	.00006	.....	.....	
12,000	12,000	.00068	.00008	.....	.....	
13,000	13,000	.00072	.00004	.....	.....	
14,000	14,000	.00080	.00008	.....	.....	
15,000	15,000	.00088	.00006	.00014	.00006	
16,000	16,000	.00092	.00006	.....	.....	
17,000	17,000	.00098	.00006	.....	.....	
18,000	18,000	.00106	.00008	.....	.....	
19,000	19,000	.00114	.00008	.....	.....	
20,000	20,000	.00120	.00006	.00020	.00006	
21,000	21,000	.00128	.00008	.....	.....	
22,000	22,000	.00134	.00006	.....	.....	
23,000	23,000	.00140	.00006	.....	.....	
24,000	24,000	.00152	.00012	.....	.....	
25,000	25,000	.00158	.00006	.00034	.00014	
26,000	26,000	.00172	.00014	.....	.....	
27,000	27,000	.00182	.00010	.....	.....	
28,000	28,000	.00190	.00008	.....	.....	
29,000	29,000	.00204	.00014	.....	.....	
30,000	30,000	.00218	.00014	.00072	.00038	
31,000	31,000	.00224	.00016	.....	.....	
32,000	32,000	.00248	.00014	.....	.....	
33,000	33,000	.00266	.00018	.....	.....	
34,000	34,000	.00282	.00016	.....	.....	
35,000	35,000	.00314	.00032	.00142	.00070	
36,000	36,000	.00354	.00040	.....	.....	
37,000	37,000	.00390	.00036	.....	.....	
38,000	38,000	.00420	.00030	.....	.....	
39,000	39,000	.00472	.00052	.....	.....	
40,000	40,000	.00502	.00060	.00202	.00150	
41,000	41,000	.00570	.00048	.....	.....	
42,000	42,000	.00604	.00024	.....	.....	
43,000	43,000	.00652	.00048	.....	.....	
44,000	44,000	.00700	.00048	.....	.....	
45,000	45,000	.00770	.00070	.00530	.00288	
46,000	46,000	.00848	.00078	.....	.....	
47,000	47,000	.00886	.00028	.....	.....	
48,000	48,000	.00930	.00044	.....	.....	
49,000	49,000	.01030	.00100	.....	.....	
50,000	50,000	.01120	.00080	.00640	.00310	
60,300	60,300	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

No. 1008.

Marks, <sup>12 M R<sub>11</sub> T R<sub>2</sub></sup>  
<sub>B R<sub>10</sub></sub>  
 Length, 10''<sup>5</sup>.  
 Diameter, 1''<sup>129</sup>.  
 Sectional area, 1 square inch.  
 Gauged length, 5''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0.	0.	0.		
2,000	2,000	.00006	.00006	.....	.....		
3,000	3,000	.00010	.00004	.....	.....		
4,000	4,000	.00016	.00008	.....	.....		
5,000	5,000	.00022	.00008	0.	.....		
6,000	6,000	.00028	.00008	.....	.....		
7,000	7,000	.00034	.00008	.....	.....		
8,000	8,000	.00038	.00004	.....	.....		
9,000	9,000	.00042	.00004	.....	.....		
10,000	10,000	.00050	.00008	.00006	.00006		
11,000	11,000	.00054	.00004	.....	.....		
12,000	12,000	.00058	.00004	.....	.....		
13,000	13,000	.00064	.00008	.....	.....		
14,000	14,000	.00070	.00008	.....	.....		
15,000	15,000	.00076	.00008	.00012	.00006		
16,000	16,000	.00084	.00008	.....	.....		
17,000	17,000	.00090	.00008	.....	.....		
18,000	18,000	.00096	.00008	.....	.....		
19,000	19,000	.00103	.00008	.....	.....		
20,000	20,000	.00110	.00008	.00014	.00002		
21,000	21,000	.00114	.00004	.....	.....		
22,000	22,000	.00122	.00008	.....	.....		
23,000	23,000	.00132	.00010	.....	.....		
24,000	24,000	.00138	.00008	.....	.....		
25,000	25,000	.00148	.00010	.00028	.00014		
26,000	26,000	.00158	.00010	.....	.....		
27,000	27,000	.00166	.00008	.....	.....		
28,000	28,000	.00178	.00012	.....	.....		
29,000	29,000	.00192	.00014	.....	.....		
30,000	30,000	.00204	.00012	.00062	.00034		
31,000	31,000	.00224	.00020	.....	.....		
32,000	32,000	.00238	.00014	.....	.....		
33,000	33,000	.00258	.00020	.....	.....		
34,000	34,000	.00284	.00026	.....	.....		
35,000	35,000	.00336	.00042	.00150	.00088		
36,000	36,000	.00360	.00034	.....	.....		
37,000	37,000	.00382	.00022	.....	.....		
38,000	38,000	.00418	.00036	.....	.....		
39,000	39,000	.00466	.00048	.....	.....		
40,000	40,000	.00544	.00078	.00356	.00206		
41,000	41,000	.00594	.00050	.....	.....		
42,000	42,000	.00634	.00040	.....	.....		
43,000	43,000	.00690	.00056	.....	.....		
44,000	44,000	.00760	.00070	.....	.....		
45,000	45,000	.00814	.00054	.00578	.00228		
46,000	46,000	.00880	.00066	.....	.....		
47,000	47,000	.00950	.00070	.....	.....		
48,000	48,000	.01036	.00086	.....	.....		
49,000	49,000	.01138	.00102	.....	.....		
50,000	50,000	.01260	.00122	.00990	.00412		
59,100	59,100	.....	.....	.....	.....		Ultimate strength.

Failed by triple flexure.



No. 1009.

Marks, <sup>12 M R<sub>11</sub> T E<sub>1</sub></sup>  
<sub>M<sup>1</sup> T<sup>1</sup></sub>

Length, 10''<sup>5</sup>.

Diameter, 1''<sup>.129</sup>.

Sectional area, 1 square inch.

Gauged length, 5''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0.	0.	0.		
2,000	2,000	.00004	.00004	.....	.....		
3,000	3,000	.00010	.00006	.....	.....		
4,000	4,000	.00014	.00004	.....	.....		
5,000	5,000	.00018	.00004	.00002	.00002		
6,000	6,000	.00026	.00008	.....	.....		
7,000	7,000	.00030	.00004	.....	.....		
8,000	8,000	.00034	.00004	.....	.....		
9,000	9,000	.00040	.00006	.....	.....		
10,000	10,000	.00046	.00006	.00004	.00002		
11,000	11,000	.00052	.00006	.....	.....		
12,000	12,000	.00058	.00006	.....	.....		
13,000	13,000	.00064	.00006	.....	.....		
14,000	14,000	.00070	.00006	.....	.....		
15,000	15,000	.00074	.00004	.00008	.00004		
16,000	16,000	.00082	.00008	.....	.....		
17,000	17,000	.00088	.00006	.....	.....		
18,000	18,000	.00094	.00006	.....	.....		
19,000	19,000	.00102	.00008	.....	.....		
20,000	20,000	.00110	.00008	.00014	.00006		
21,000	21,000	.00120	.00010	.....	.....		
22,000	22,000	.00126	.00006	.....	.....		
23,000	23,000	.00132	.00006	.....	.....		
24,000	24,000	.00140	.00008	.....	.....		
25,000	25,000	.00152	.00012	.00030	.00016		
26,000	26,000	.00164	.00012	.....	.....		
27,000	27,000	.00172	.00008	.....	.....		
28,000	28,000	.00184	.00012	.....	.....		
29,000	29,000	.00196	.00012	.....	.....		
30,000	30,000	.00214	.00018	.00054	.00034		
31,000	31,000	.00232	.00018	.....	.....		
32,000	32,000	.00250	.00018	.....	.....		
33,000	33,000	.00276	.00026	.....	.....		
34,000	34,000	.00304	.00028	.....	.....		
35,000	35,000	.00334	.00030	.00156	.00092		
36,000	36,000	.00376	.00042	.....	.....		
37,000	37,000	.00414	.00038	.....	.....		
38,000	38,000	.00444	.00030	.....	.....		
39,000	39,000	.00480	.00036	.....	.....		
40,000	40,000	.00544	.00064	.00350	.00194		
41,000	41,000	.00592	.00048	.....	.....		
42,000	42,000	.00646	.00054	.....	.....		
43,000	43,000	.00692	.00046	.....	.....		
44,000	44,000	.00744	.00052	.....	.....		
45,000	45,000	.00788	.00042	.00556	.00296		
46,000	46,000	.00876	.00060	.....	.....		
47,000	47,000	.00906	.00030	.....	.....		
48,000	48,000	.00930	.00024	.....	.....		
49,000	49,000	.00960	.00060	.....	.....		
50,000	50,000	.00984	.00024	.00734	.00178		
57,500	57,500						Ultimate strength.

Failed by triple flexure.

BODY No. 14 (second casting).

No. 4666.

Marks, 12 M R<sub>1</sub> T R<sub>2</sub>  
B T<sub>11</sub>Diameter, 1<sup>11</sup>/<sub>16</sub> .129.

Sectional area, 1 square inch.

Length of stem, 23<sup>11</sup>/<sub>16</sub>.Gauged length, 20<sup>11</sup>/<sub>16</sub>.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.000050	.000050	.....	.....	
3,000	3,000	.000100	.000050	.....	.....	
4,000	4,000	.000150	.000050	.....	.....	
5,000	5,000	.000200	.000050	0.	.....	
6,000	6,000	.000250	.000050	.....	.....	
7,000	7,000	.000315	.000055	.....	.....	
8,000	8,000	.000365	.000050	.....	.....	
9,000	9,000	.000425	.000060	.....	.....	
10,000	10,000	.000495	.000070	.000025	.000025	
11,000	11,000	.000550	.000055	.....	.....	
12,000	12,000	.000610	.000060	.000035	.000010	
13,000	13,000	.000680	.000070	.....	.....	
14,000	14,000	.000750	.000070	.000055	.000020	
15,000	15,000	.000830	.000080	.....	.....	
16,000	16,000	.000910	.000080	.000100	.000045	
17,000	17,000	.001000	.000090	.....	.....	
18,000	18,000	.001100	.000100	.000160	.000060	
19,000	19,000	.001210	.000110	.....	.....	
20,000	20,000	.001325	.000115	.000255	.000095	
21,000	21,000	.001490	.000165	.....	.....	
22,000	22,000	.001650	.000180	.000445	.000180	
23,000	23,000	.001850	.000200	.....	.....	
24,000	24,000	.002050	.000200	.000895	.000250	
25,000	25,000	.002350	.000300	.000960	.000205	
26,120	26,120	.....	.....	.....	.....	Tensile strength.

Fractured 5<sup>11</sup>/<sub>16</sub> from neck. Appearance, granular.

No. 4067.

Marks, <sup>13 M R<sub>11</sub> T E<sub>1</sub></sup>  
<sub>M T<sub>11</sub></sub>  
 Diameter, 1'' .129.  
 Sectional area, 1 square inch.  
 Length of stem, 23''.  
 Gauged length, 20''.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.000050	.000050	-----	-----	
3,000	3,000	.000100	.000050	-----	-----	
4,000	4,000	.000150	.000050	-----	-----	
5,000	5,000	.000200	.000050	0.	-----	
6,000	6,000	.000250	.000050	-----	-----	
7,000	7,000	.000300	.000050	-----	-----	
8,000	8,000	.000355	.000055	-----	-----	
9,000	9,000	.000405	.000050	-----	-----	
10,000	10,000	.000460	.000055	.000025	.000025	
11,000	11,000	.000520	.000060	-----	-----	
12,000	12,000	.000590	.000070	.000045	.000090	
13,000	13,000	.000650	.000080	-----	-----	
14,000	14,000	.000705	.000055	.000050	.000065	
15,000	15,000	.000775	.000070	-----	-----	
16,000	16,000	.000850	.000075	.000085	.000085	
17,000	17,000	.000910	.000080	-----	-----	
18,000	18,000	.001000	.000090	.000125	.000040	
19,000	19,000	.001090	.000090	-----	-----	
20,000	20,000	.001190	.000100	.000195	.000070	
21,000	21,000	.001295	.000105	-----	-----	
22,000	22,000	.001410	.000115	.000300	.000195	
23,000	23,000	.001560	.000150	-----	-----	
24,000	24,000	.001720	.000160	.000455	.000155*	
25,000	25,000	.001900	.000180	.000500	.000140	
29,100	29,100	-----	-----	-----	-----	

Fractured 10'' from neck. Appearance, granular.

No. 1034.

Marks, <sup>12 M R<sub>14</sub> T R<sub>2</sub></sup>  
<sup>B L<sub>12</sub></sup>  
 Length, 10'' .5.  
 Diameter, 1'' .129.  
 Sectional area, 1 square inch.  
 Gauged length, 5''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0.	0.	0.		
2,000	2,000	.00004	.00004				
3,000	3,000	.00010	.00006				
4,000	4,000	.00014	.00004				
5,000	5,000	.00018	.00004	0.			
6,000	6,000	.00024	.00006				
7,000	7,000	.00028	.00004				
8,000	8,000	.00032	.00004				
9,000	9,000	.00038	.00006				
10,000	10,000	.00044	.00006	.00002	.00002		
11,000	11,000	.00050	.00006				
12,000	12,000	.00054	.00004				
13,000	13,000	.00060	.00006				
14,000	14,000	.00064	.00004				
15,000	15,000	.00070	.00006	.00006	.00004		
16,000	16,000	.00076	.00006				
17,000	17,000	.00082	.00006				
18,000	18,000	.00086	.00004				
19,000	19,000	.00092	.00006				
20,000	20,000	.00098	.00006	.00010	.00004		
21,000	21,000	.00106	.00008				
22,000	22,000	.00112	.00006				
23,000	23,000	.00120	.00008				
24,000	24,000	.00128	.00008				
25,000	25,000	.00140	.00012	.00022	.00012		
26,000	26,000	.00146	.00006				
27,000	27,000	.00152	.00006				
28,000	28,000	.00162	.00010				
29,000	29,000	.00174	.00012				
30,000	30,000	.00188	.00014	.00046	.00024		
31,000	31,000	.00204	.00016				
32,000	32,000	.00220	.00016				
33,000	33,000	.00244	.00024				
34,000	34,000	.00270	.00026				
35,000	35,000	.00292	.00022	.00124	.00078		
36,000	36,000	.00326	.00034				
37,000	37,000	.00356	.00030				
38,000	38,000	.00398	.00042				
39,000	39,000	.00430	.00032				
40,000	40,000	.00478	.00048	.00284	.00160		
41,000	41,000	.00544	.00066				
42,000	42,000	.00580	.00036				
43,000	43,000	.00624	.00044				
44,000	44,000	.00682	.00058				
45,000	45,000	.00734	.00052	.00508	.00224		
46,000	46,000	.00782	.00048				
47,000	47,000	.00826	.00044				
48,000	48,000	.00858	.00032				
49,000	49,000	.00918	.00060				
50,000	50,000	.00972	.00054	.00720	.00212		
60,900	60,900						Ultimate strength.

Failed by triple flexure.

No. 1035.

Marks,  $12 M R_{14} T R_2$   
 $B R_{20}$   
 Length, 10' 5".  
 Diameter, 1" .129.  
 Sectional area, 1 square inch.  
 Gauged length, 5'.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0.	0.	0.		
2,000	2,000	.00004	.00004				
3,000	3,000	.00008	.00004				
4,000	4,000	.00012	.00004				
5,000	5,000	.00018	.00006	0.			
6,000	6,000	.00022	.00004				
7,000	7,000	.00026	.00004				
8,000	8,000	.00032	.00006				
9,000	9,000	.00036	.00004				
10,000	10,000	.00042	.00006	0.			
11,000	11,000	.00046	.00004				
12,000	12,000	.00052	.00006				
13,000	13,000	.00058	.00006				
14,000	14,000	.00064	.00006				
15,000	15,000	.00068	.00004	.00004	.00004		
16,000	16,000	.00074	.00006				
17,000	17,000	.00080	.00006				
18,000	18,000	.00086	.00006				
19,000	19,000	.00092	.00006				
20,000	20,000	.00098	.00006	.00010	.00006		
21,000	21,000	.00106	.00008				
22,000	22,000	.00112	.00006				
23,000	23,000	.00118	.00006				
24,000	24,000	.00124	.00006				
25,000	25,000	.00132	.00008	.00020	.00010		
26,000	26,000	.00142	.00010				
27,000	27,000	.00150	.00008				
28,000	28,000	.00160	.00010				
29,000	29,000	.00172	.00012				
30,000	30,000	.00186	.00014	.00068	.00048		
31,000	31,000	.00208	.00022				
32,000	32,000	.00224	.00016				
33,000	33,000	.00242	.00018				
34,000	34,000	.00268	.00026				
35,000	35,000	.00300	.00032	.00134	.00066		
36,000	36,000	.00342	.00042				
37,000	37,000	.00378	.00036				
38,000	38,000	.00418	.00040				
39,000	39,000	.00458	.00040				
40,000	40,000	.00520	.00062	.00326	.00192		
41,000	41,000	.00562	.00042				
42,000	42,000	.00620	.00058				
43,000	43,000	.00654	.00034				
44,000	44,000	.00710	.00050				
45,000	45,000	.00814	.00104	.00584	.00258		
46,000	46,000	.00848	.00034				
47,000	47,000	.00888	.00040				
48,000	48,000	.00952	.00064				
49,000	49,000	.01028	.00076				
50,000	50,000	.01108	.00080	.00848	.00264		
61,780	61,780						Ultimate strength.

Failed by triple flexure.

No. 1036.

Marks,  $12 M R_{14} T R_1$   
 $M T_{11}$

Length, 10' 5".

Diameter, 1" .129.

Sectional area, 1 square inch.

Gauged length, 5'.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0.	0.	0.		
2,000	2,000	.00004	.00004				
3,000	3,000	.00008	.00004				
4,000	4,000	.00012	.00004				
5,000	5,000	.00018	.00006	0.			
6,000	6,000	.00024	.00006				
7,000	7,000	.00028	.00004				
8,000	8,000	.00032	.00004				
9,000	9,000	.00036	.00004				
10,000	10,000	.00042	.00006	.00002	.00002		
11,000	11,000	.00048	.00006				
12,000	12,000	.00052	.00004				
13,000	13,000	.00058	.00006				
14,000	14,000	.00062	.00004				
15,000	15,000	.00068	.00006	.00004	.00002		
16,000	16,000	.00074	.00006				
17,000	17,000	.00080	.00006				
18,000	18,000	.00086	.00006				
19,000	19,000	.00092	.00006				
20,000	20,000	.00096	.00004	.00006	.00004		
21,000	21,000	.00104	.00008				
22,000	22,000	.00110	.00006				
23,000	23,000	.00118	.00008				
24,000	24,000	.00124	.00006				
25,000	25,000	.00132	.00008	.00018	.00010		
26,000	26,000	.00140	.00008				
27,000	27,000	.00150	.00010				
28,000	28,000	.00158	.00008				
29,000	29,000	.00168	.00010				
30,000	30,000	.00184	.00016	.00046	.00028		
31,000	31,000	.00202	.00018				
32,000	32,000	.00220	.00018				
33,000	33,000	.00236	.00016				
34,000	34,000	.00258	.00022				
35,000	35,000	.00284	.00026	.00118	.00072		
36,000	36,000	.00320	.00036				
37,000	37,000	.00360	.00040				
38,000	38,000	.00392	.00032				
39,000	39,000	.00440	.00048				
40,000	40,000	.00516	.00076	.00322	.00204		
41,000	41,000	.00562	.00046				
42,000	42,000	.00602	.00040				
43,000	43,000	.00664	.00062				
44,000	44,000	.00728	.00064				
45,000	45,000	.00790	.00062	.00506	.00244		
46,000	46,000	.00840	.00056				
47,000	47,000	.00880	.00040				
48,000	48,000	.00936	.00056				
49,000	49,000	.01016	.00080				
50,000	50,000	.01092	.00076	.00856	.00270		
50,000	50,000						Ultimate strength.

Failed by triple flexure.

## BODY No. 15.

No. 4604.

Marks, <sup>12 M R<sub>1</sub> T R<sub>2</sub></sup>  
<sub>B T<sub>1</sub></sub>

Diameter, 1".129.

Sectional area, 1 square inch.

Length of stem, 23".

Gauged length, 20".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.000055	.000055			
3,000	3,000	.000105	.000050			
4,000	4,000	.000160	.000055			
5,000	5,000	.000215	.000055	0.		
6,000	6,000	.000280	.000065			
7,000	7,000	.000340	.000060			
8,000	8,000	.000405	.000065			
9,000	9,000	.000475	.000070			
10,000	10,000	.000540	.000065	.000040	.000040	
11,000	11,000	.000615	.000075			
12,000	12,000	.000700	.000085	.000065	.000025	
13,000	13,000	.000780	.000080			
14,000	14,000	.000850	.000070	.000105	.000040	
15,000	15,000	.000950	.000100			
16,000	16,000	.001045	.000095	.000180	.000055	
17,000	17,000	.001155	.000110			
18,000	18,000	.001290	.000135	.000250	.000080	
19,000	19,000	.001435	.000145			
20,000	20,000	.001600	.000165	.000415	.000185	
21,000	21,000	.001775	.000175			
22,000	22,000	.002000	.000225	.000685	.000250	
23,000	23,000	.002300	.000300			
24,000	24,000	.002650	.000350	.001150	.000485	
25,680	25,800					Tensile strength.

Fractured  $3\frac{1}{2}$ " from neck. Appearance, granular, with coarse stellar arrangement.

No. 4605.

Marks, <sup>12 M R, T R,</sup>  
<sub>M 1,</sub>

Diameter, 1".129.

Sectional area, 1 square inch.

Length of stem, 23".

Gauged length, 20".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.000055	.000055	.....	.....	
3,000	3,000	.000105	.000050	.....	.....	
4,000	4,000	.000155	.000050	.....	.....	
5,000	5,000	.000210	.000055	.....	.....	
6,000	6,000	.000280	.000050	.....	.....	
7,000	7,000	.000315	.000055	.....	.....	
8,000	8,000	.000375	.000060	.....	.....	
9,000	9,000	.000440	.000065	.....	.....	
10,000	10,000	.000505	.000065	.000025	.000025	
11,000	11,000	.000565	.000060	.....	.....	
12,000	12,000	.000630	.000065	.000045	.000020	
13,000	13,000	.000685	.000065	.....	.....	
14,000	14,000	.000760	.000065	.000055	.000010	
15,000	15,000	.000840	.000060	.....	.....	
16,000	16,000	.000915	.000075	.000095	.000040	
17,000	17,000	.001000	.000085	.....	.....	
18,000	18,000	.001100	.000100	.000155	.000060	
19,000	19,000	.001200	.000100	.....	.....	
20,000	20,000	.001320	.000120	.000240	.000085	
21,000	21,000	.001480	.000170	.....	.....	
22,000	22,000	.001655	.000165	.000420	.000180	
23,000	23,000	.001825	.000170	.....	.....	
24,000	24,000	.002100	.000275	.000705	.000285	
25,000	25,000	.002400	.000300	.....	.....	
						Tensile strength.

Fractured 9½" from neck. Appearance, uniform, granular.



No. 1013.

Marks, <sup>12 M B, T R,</sup>  
<sub>B 1,</sub>  
 Length, 10''<sup>5</sup>.  
 Diameter, 1''<sup>.129</sup>.  
 Sectional area, 1 square inch.  
 Gauged length, 5''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0.	0.	0.		
2,000	2,000	.00004	.00004	.....	.....		
3,000	3,000	.00008	.00004	.....	.....		
4,000	4,000	.00012	.00004	.....	.....		
5,000	5,000	.00016	.00004	0.	.....		
6,000	6,000	.00024	.00008	.....	.....		
7,000	7,000	.00028	.00004	.....	.....		
8,000	8,000	.00034	.00006	.....	.....		
9,000	9,000	.00038	.00004	.....	.....		
10,000	10,000	.00044	.00006	.00004	.00004		
11,000	11,000	.00052	.00008	.....	.....		
12,000	12,000	.00058	.00006	.....	.....		
13,000	13,000	.00066	.00008	.....	.....		
14,000	14,000	.00070	.00004	.....	.....		
15,000	15,000	.00078	.00008	.00008	.00004		
16,000	16,000	.00084	.00006	.....	.....		
17,000	17,000	.00090	.00006	.....	.....		
18,000	18,000	.00096	.00006	.....	.....		
19,000	19,000	.00104	.00008	.....	.....		
20,000	20,000	.00112	.00008	.00014	.00006		
21,000	21,000	.00118	.00006	.....	.....		
22,000	22,000	.00128	.00010	.....	.....		
23,000	23,000	.00138	.00010	.....	.....		
24,000	24,000	.00148	.00010	.....	.....		
25,000	25,000	.00158	.00010	.00028	.00014		
26,000	26,000	.00170	.00012	.....	.....		
27,000	27,000	.00182	.00012	.....	.....		
28,000	28,000	.00192	.00010	.....	.....		
29,000	29,000	.00204	.00012	.....	.....		
30,000	30,000	.00224	.00020	.00064	.00036		
31,000	31,000	.00240	.00016	.....	.....		
32,000	32,000	.00264	.00024	.....	.....		
33,000	33,000	.00284	.00020	.....	.....		
34,000	34,000	.00310	.00026	.....	.....		
35,000	35,000	.00344	.00034	.00160	.00096		
36,000	36,000	.00376	.00032	.....	.....		
37,000	37,000	.00424	.00048	.....	.....		
38,000	38,000	.00466	.00042	.....	.....		
39,000	39,000	.00500	.00038	.....	.....		
40,000	40,000	.00550	.00050	.00340	.00180		
41,000	41,000	.00600	.00050	.....	.....		
42,000	42,000	.00644	.00044	.....	.....		
43,000	43,000	.00672	.00038	.....	.....		
44,000	44,000	.00760	.00088	.....	.....		
45,000	45,000	.00792	.00032	.00550	.00216		
46,000	46,000	.00840	.00048	.....	.....		
47,000	47,000	.00888	.00028	.....	.....		
48,000	48,000	.00896	.00028	.....	.....		
49,000	49,000	.00910	.00014	.....	.....		
50,000	50,000	.00930	.00020	.00684	.00134		
56,550	56,550	.....	.....	.....	.....		Ultimate strength.

Failed by triple flexure.

No. 1014.

Marks, <sup>12 M R<sub>15</sub> T B<sub>2</sub></sup>  
<sub>B R<sub>10</sub></sub>  
 Length, 10<sup>1</sup>/<sub>2</sub>.  
 Diameter, 1<sup>1</sup>/<sub>2</sub>.129.  
 Sectional area, 1 square inch.  
 Gauged length, 5<sup>1</sup>/<sub>2</sub>.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0.	0.	0.		
2,000	2,000	.00004	.00004	.....	.....		
3,000	3,000	.00008	.00004	.....	.....		
4,000	4,000	.00014	.00006	.....	.....		
5,000	5,000	.00018	.00004	0.	.....		
6,000	6,000	.00024	.00006	.....	.....		
7,000	7,000	.00030	.00006	.....	.....		
8,000	8,000	.00034	.00004	.....	.....		
9,000	9,000	.00040	.00006	.....	.....		
10,000	10,000	.00048	.00008	.00004	.00004		
11,000	11,000	.00054	.00006	.....	.....		
12,000	12,000	.00058	.00004	.....	.....		
13,000	13,000	.00064	.00006	.....	.....		
14,000	14,000	.00068	.00004	.....	.....		
15,000	15,000	.00074	.00006	.00008	.00004		
16,000	16,000	.00080	.00006	.....	.....		
17,000	17,000	.00086	.00006	.....	.....		
18,000	18,000	.00094	.00008	.....	.....		
19,000	19,000	.00102	.00008	.....	.....		
20,000	20,000	.00108	.00006	.00012	.00004		
21,000	21,000	.00114	.00006	.....	.....		
22,000	22,000	.00124	.00010	.....	.....		
23,000	23,000	.00130	.00006	.....	.....		
24,000	24,000	.00140	.00010	.....	.....		
25,000	25,000	.00152	.00012	.00026	.00014		
26,000	26,000	.00160	.00008	.....	.....		
27,000	27,000	.00174	.00014	.....	.....		
28,000	28,000	.00182	.00008	.....	.....		
29,000	29,000	.00194	.00012	.....	.....		
30,000	30,000	.00212	.00018	.00080	.00032		
31,000	31,000	.00228	.00016	.....	.....		
32,000	32,000	.00252	.00024	.....	.....		
33,000	33,000	.00284	.00032	.....	.....		
34,000	34,000	.00310	.00026	.....	.....		
35,000	35,000	.00336	.00026	.00164	.00104		
36,000	36,000	.00376	.00040	.....	.....		
37,000	37,000	.00420	.00044	.....	.....		
38,000	38,000	.00460	.00040	.....	.....		
39,000	39,000	.00510	.00050	.....	.....		
40,000	40,000	.00576	.00066	.00370	.00206		
41,000	41,000	.00630	.00054	.....	.....		
42,000	42,000	.00684	.00054	.....	.....		
43,000	43,000	.00724	.00040	.....	.....		
44,000	44,000	.00814	.00080	.....	.....		
45,000	45,000	.00900	.00066	.00670	.00300		
46,000	46,000	.00960	.00060	.....	.....		
47,000	47,000	.01040	.00080	.....	.....		
48,000	48,000	.01120	.00080	.....	.....		
49,000	49,000	.01230	.00110	.....	.....		
50,000	50,000	.01400	.00170	.01120	.00450		
57,580	57,580	.....	.....	.....	.....		Ultimate strength.

Failed by triple flexure.

No. 1015.

Marks, <sup>12 M R<sub>15</sub> T R,</sup>  
<sub>M T<sub>1</sub></sub>  
 Length, 10'' .5.  
 Diameter, 1'' .129.  
 Sectional area, 1 square inch.  
 Gauged length, 5''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0.	0.	0.		
2,000	2,000	.00004	.00004				
3,000	3,000	.00008	.00004				
4,000	4,000	.00012	.00004				
5,000	5,000	.00016	.00004	0.			
6,000	6,000	.00022	.00006				
7,000	7,000	.00028	.00006				
8,000	8,000	.00032	.00004				
9,000	9,000	.00038	.00006				
10,000	10,000	.00046	.00008	.00004	.00004		
11,000	11,000	.00050	.00004				
12,000	12,000	.00054	.00004				
13,000	13,000	.00060	.00006				
14,000	14,000	.00066	.00006				
15,000	15,000	.00072	.00006	.00006	.00002		
16,000	16,000	.00078	.00006				
17,000	17,000	.00086	.00008				
18,000	18,000	.00092	.00006				
19,000	19,000	.00098	.00006				
20,000	20,000	.00104	.00006	.00010	.00014		
21,000	21,000	.00112	.00008				
22,000	22,000	.00116	.00004				
23,000	23,000	.00124	.00008				
24,000	24,000	.00132	.00008				
25,000	25,000	.00144	.00012	.00022	.00012		
26,000	26,000	.00154	.00010				
27,000	27,000	.00162	.00008				
28,000	28,000	.00172	.00010				
29,000	29,000	.00184	.00012				
30,000	30,000	.00196	.00012	.00048	.00026		
31,000	31,000	.00214	.00018				
32,000	32,000	.00232	.00018				
33,000	33,000	.00254	.00022				
34,000	34,000	.00278	.00024				
35,000	35,000	.00300	.00022	.00124	.00076		
36,000	36,000	.00344	.00044				
37,000	37,000	.00380	.00036				
38,000	38,000	.00430	.00050				
39,000	39,000	.00472	.00042				
40,000	40,000	.00514	.00042	.00320	.00196		
41,000	41,000	.00568	.00054				
42,000	42,000	.00630	.00062				
43,000	43,000	.00678	.00048				
44,000	44,000	.00750	.00072				
45,000	45,000	.00824	.00074	.00590	.00270		
46,000	46,000	.00884	.00060				
47,000	47,000	.00954	.00070				
48,000	48,000	.01024	.00070				
49,000	49,000	.01120	.00104				
50,000	50,000	.01202	.00082	.00944	.00554		
55,680	55,680						Ultimate strength.

Failed by triple flexure.

H. Ex. 43—14

BODY No. 15 (second casting).

No. 4668.

Marks, <sup>12 M R, T R</sup><sub>B T<sub>11</sub></sub>Diameter, 1<sup>11</sup>/<sub>16</sub> .129.

Sectional area, 1 square inch.

Length of stem, 23<sup>11</sup>/<sub>16</sub>.Gauged length, 20<sup>11</sup>/<sub>16</sub>.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.000050	.000050			
3,000	3,000	.000100	.000050			
4,000	4,000	.000155	.000055			
5,000	5,000	.000205	.000050	.000010	.000010	
6,000	6,000	.000260	.000055			
7,000	7,000	.000320	.000060			
8,000	8,000	.000380	.000070			
9,000	9,000	.000445	.000055			
10,000	10,000	.000500	.000055	.000040	.000030	
11,000	11,000	.000560	.000060			
12,000	12,000	.000630	.000070	.000050	.000010	
13,000	13,000	.000700	.000070			
14,000	14,000	.000770	.000070	.000090	.000040	
15,000	15,000	.000850	.000080			
16,000	16,000	.000925	.000075	.000110	.000020	
17,000	17,000	.001010	.000085			
18,000	18,000	.001110	.000100	.000190	.000080	
19,000	19,000	.001215	.000105			
20,000	20,000	.001340	.000125	.000290	.000100	
21,000	21,000	.001485	.000145			
22,000	22,000	.001625	.000140	.000450	.000160	
23,000	23,000	.001825	.000200			
24,000	24,000	.002040	.000215	.000700	.000250	
25,000	25,000	.002350	.000310	.000900	.000200	
27,120	27,120					Tensile strength.

Fractured 3<sup>11</sup>/<sub>16</sub> from neck. Appearance, granular.

No. 4669.

Marks, <sup>13 M R<sub>11</sub> T B<sub>1</sub></sup>  
<sub>M 1<sub>11</sub></sub>

Diameter, 1".129.

Sectional area, 1 square inch.

Length of stem, 23".

Gauged length, 20".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.000050	.000050	.....	.....	
3,000	3,000	.000100	.000050	.....	.....	
4,000	4,000	.000150	.000050	.....	.....	
5,000	5,000	.000200	.000050	0."	.....	
6,000	6,000	.000250	.000050	.....	.....	
7,000	7,000	.000300	.000050	.....	.....	
8,000	8,000	.000350	.000050	.....	.....	
9,000	9,000	.000400	.000050	.....	.....	
10,000	10,000	.000450	.000050	.000015	.000015	
11,000	11,000	.000510	.000050	.....	.....	
12,000	12,000	.000560	.000050	.000040	.000025	
13,000	13,000	.000635	.000075	.....	.....	
14,000	14,000	.000700	.000065	.000050	.000010	
15,000	15,000	.000755	.000055	.....	.....	
16,000	16,000	.000820	.000065	.000090	.000040	
17,000	17,000	.000900	.000080	.....	.....	
18,000	18,000	.000980	.000080	.000115	.000025	
19,000	19,000	.001060	.000080	.....	.....	
20,000	20,000	.001145	.000085	.000180	.000065	
21,000	21,000	.001255	.000110	.....	.....	
22,000	22,000	.001360	.000105	.000265	.000085	
23,000	23,000	.001500	.000140	.....	.....	
24,000	24,000	.001650	.000150	.000420	.000155	
25,000	25,000	.001825	.000175	.000550	.000130	
29,050	29,050	.....	.....	.....	.....	

Fractured 2".1 from neck. Appearance, granular.

No. 1037.

Marks, <sup>12 M R<sub>15</sub> T R<sub>2</sub></sup>  
<sub>B T<sub>12</sub></sub>  
 Length, 10<sup>1</sup>/<sub>5</sub>.  
 Diameter, 1<sup>1</sup>/<sub>129</sub>.  
 Sectional area, 1 square inch.  
 Gauged length, 5<sup>1</sup>/<sub>2</sub>.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0.	0.	0.		
2,000	2,000	.00004	.00004	.....	.....		
3,000	3,000	.00008	.00004	.....	.....		
4,000	4,000	.00012	.00004	.....	.....		
5,000	5,000	.00018	.00006	0.	.....		
6,000	6,000	.00024	.00006	.....	.....		
7,000	7,000	.00030	.00006	.....	.....		
8,000	8,000	.00034	.00004	.....	.....		
9,000	9,000	.00040	.00006	.....	.....		
10,000	10,000	.00046	.00006	.00004	.00304		
11,000	11,000	.00052	.00006	.....	.....		
12,000	12,000	.00056	.00004	.....	.....		
13,000	13,000	.00060	.00004	.....	.....		
14,000	14,000	.00066	.00006	.....	.....		
15,000	15,000	.00072	.00006	.00006	.00002		
16,000	16,000	.00076	.00004	.....	.....		
17,000	17,000	.00082	.00006	.....	.....		
18,000	18,000	.00088	.00006	.....	.....		
19,000	19,000	.00094	.00006	.....	.....		
20,000	20,000	.00102	.00008	.00010	.00004		
21,000	21,000	.00108	.00006	.....	.....		
22,000	22,000	.00114	.00006	.....	.....		
23,000	23,000	.00122	.00008	.....	.....		
24,000	24,000	.00130	.00008	.....	.....		
25,000	25,000	.00136	.00006	.00022	.00012		
26,000	26,000	.00144	.00008	.....	.....		
27,000	27,000	.00154	.00010	.....	.....		
28,000	28,000	.00166	.00012	.....	.....		
29,000	29,000	.00176	.00010	.....	.....		
30,000	30,000	.00190	.00014	.00050	.00028		
31,000	31,000	.00210	.00020	.....	.....		
32,000	32,000	.00226	.00016	.....	.....		
33,000	33,000	.00244	.00018	.....	.....		
34,000	34,000	.00272	.00028	.....	.....		
35,000	35,000	.00302	.00030	.00134	.00084		
36,000	36,000	.00340	.00038	.....	.....		
37,000	37,000	.00370	.00030	.....	.....		
38,000	38,000	.00412	.00042	.....	.....		
39,000	39,000	.00456	.00044	.....	.....		
40,000	40,000	.00504	.00048	.00306	.00172		
41,000	41,000	.00550	.00046	.....	.....		
42,000	42,000	.00590	.00040	.....	.....		
43,000	43,000	.00632	.00042	.....	.....		
44,000	44,000	.00682	.00050	.....	.....		
45,000	45,000	.00750	.00068	.00524	.00218		
46,000	46,000	.00806	.00056	.....	.....		
47,000	47,000	.00840	.00034	.....	.....		
48,000	48,000	.00858	.00048	.....	.....		
49,000	49,000	.00940	.00038	.....	.....		
50,000	50,000	.01002	.00056	.00748	.00224		
61,650	61,650	.....	.....	.....	.....		Ultimate strength.

Failed by triple flexure.

No. 1038.

Marks,  $12 M R_{12} T R_2$   
 $B R_{20}$   
 Length,  $10'' .5$ .  
 Diameter,  $1'' .129$ .  
 Sectional area, 1 square inch.  
 Gauged length,  $5''$ .

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0.	0.	0.		
2,000	2,000	.00004	.00004	.....	.....		
3,000	3,000	.00010	.00006	.....	.....		
4,000	4,000	.00014	.00004	.....	.....		
5,000	5,000	.00018	.00004	0.	.....		
6,000	6,000	.00024	.00006	.....	.....		
7,000	7,000	.00028	.00004	.....	.....		
8,000	8,000	.00032	.00004	.....	.....		
9,000	9,000	.00036	.00014	.....	.....		
10,000	10,000	.00042	.00006	.00002	.00002		
11,000	11,000	.00050	.00008	.....	.....		
12,000	12,000	.00054	.00004	.....	.....		
13,000	13,000	.00060	.00006	.....	.....		
14,000	14,000	.00064	.00004	.....	.....		
15,000	15,000	.00070	.00006	.00006	.00004		
16,000	16,000	.00076	.00006	.....	.....		
17,000	17,000	.00082	.00006	.....	.....		
18,000	18,000	.00088	.00006	.....	.....		
19,000	19,000	.00094	.00006	.....	.....		
20,000	20,000	.00100	.00006	.00010	.00004		
21,000	21,000	.00106	.00008	.....	.....		
22,000	22,000	.00112	.00004	.....	.....		
23,000	23,000	.00120	.00008	.....	.....		
24,000	24,000	.00128	.00008	.....	.....		
25,000	25,000	.00134	.00006	.00022	.00012		
26,000	26,000	.00144	.00010	.....	.....		
27,000	27,000	.00152	.00008	.....	.....		
28,000	28,000	.00164	.00012	.....	.....		
29,000	29,000	.00174	.00010	.....	.....		
30,000	30,000	.00196	.00022	.00060	.00038		
31,000	31,000	.00212	.00016	.....	.....		
32,000	32,000	.00230	.00018	.....	.....		
33,000	33,000	.00246	.00016	.....	.....		
34,000	34,000	.00264	.00018	.....	.....		
35,000	35,000	.00296	.00032	.00130	.00070		
36,000	36,000	.00324	.00028	.....	.....		
37,000	37,000	.00374	.00050	.....	.....		
38,000	38,000	.00412	.00038	.....	.....		
39,000	39,000	.00472	.00060	.....	.....		
40,000	40,000	.00520	.00048	.00326	.00196		
41,000	41,000	.00564	.00044	.....	.....		
42,000	42,000	.00612	.00048	.....	.....		
43,000	43,000	.00654	.00042	.....	.....		
44,000	44,000	.00712	.00058	.....	.....		
45,000	45,000	.00774	.00062	.00576	.00250		
46,000	46,000	.00832	.00058	.....	.....		
47,000	47,000	.00892	.00060	.....	.....		
48,000	48,000	.00946	.00054	.....	.....		
49,000	49,000	.01000	.00054	.....	.....		
50,000	50,000	.01060	.00060	.00802	.00226		
61,560	61,560	.....	.....	.....	.....		Ultimate strength.

Failed by triple flexure.

No. 1037.

Marks, <sup>12</sup> M R<sub>1</sub> T R<sub>2</sub>  
<sup>B T<sub>12</sub></sup>  
 Length, 10' 5".  
 Diameter, 1' 129.  
 Sectional area, 1 square inch.  
 Gauged length, 5'.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0.	0.	0.		
2,000	2,000	.00004	.00004				
3,000	3,000	.00008	.00008				
4,000	4,000	.00012	.00012				
5,000	5,000	.00018	.00018	0.			
6,000	6,000	.00024	.00024				
7,000	7,000	.00030	.00030				
8,000	8,000	.00034	.00034				
9,000	9,000	.00040	.00040				
10,000	10,000	.00046	.00046	.00004	.00004		
11,000	11,000	.00052	.00052				
12,000	12,000	.00056	.00056				
13,000	13,000	.00060	.00060				
14,000	14,000	.00066	.00066				
15,000	15,000	.00072	.00072	.00006	.00002		
16,000	16,000	.00076	.00076				
17,000	17,000	.00082	.00082				
18,000	18,000	.00088	.00088				
19,000	19,000	.00094	.00094				
20,000	20,000	.00102	.00102	.00010	.00004		
21,000	21,000	.00108	.00108				
22,000	22,000	.00114	.00114				
23,000	23,000	.00122	.00122				
24,000	24,000	.00130	.00130				
25,000	25,000	.00136	.00136	.00022	.00012		
26,000	26,000	.00144	.00144				
27,000	27,000	.00154	.00154				
28,000	28,000	.00166	.00166				
29,000	29,000	.00176	.00176				
30,000	30,000	.00190	.00190	.00050	.00026		
31,000	31,000	.00210	.00210				
32,000	32,000	.00226	.00226				
33,000	33,000	.00244	.00244				
34,000	34,000	.00272	.00272				
35,000	35,000	.00302	.00302	.00134	.00084		
36,000	36,000	.00340	.00340				
37,000	37,000	.00370	.00370				
38,000	38,000	.00412	.00412				
39,000	39,000	.00456	.00456				
40,000	40,000	.00504	.00504	.00306	.00172		
41,000	41,000	.00550	.00550				
42,000	42,000	.00590	.00590				
43,000	43,000	.00632	.00632				
44,000	44,000	.00682	.00682				
45,000	45,000	.00750	.00750	.00524	.00218		
46,000	46,000	.00806	.00806				
47,000	47,000	.00840	.00840				
48,000	48,000	.00886	.00886				
49,000	49,000	.00946	.00946				
50,000	50,000	.01002	.01002	.00748	.00224		
61,650	61,650						Ultimate strength.

Failed by triple flexure.



No. 1038.

Marks, 12 M R<sub>15</sub> T R<sub>2</sub>  
 B R<sub>20</sub>  
 Length, 10''<sup>5</sup>/<sub>8</sub>.  
 Diameter, 1''<sup>129</sup>/<sub>16</sub>.  
 Sectional area, 1 square inch.  
 Gauged length, 5''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.00004	.00004	.....	.....	
3,000	3,000	.00010	.00006	.....	.....	
4,000	4,000	.00014	.00004	.....	.....	
5,000	5,000	.00018	.00004	0.	.....	
6,000	6,000	.00024	.00006	.....	.....	
7,000	7,000	.00028	.00004	.....	.....	
8,000	8,000	.00032	.00004	.....	.....	
9,000	9,000	.00036	.00004	.....	.....	
10,000	10,000	.00042	.00006	.00002	.00002	
11,000	11,000	.00050	.00008	.....	.....	
12,000	12,000	.00054	.00004	.....	.....	
13,000	13,000	.00060	.00006	.....	.....	
14,000	14,000	.00064	.00004	.....	.....	
15,000	15,000	.00070	.00006	.00006	.00004	
16,000	16,000	.00076	.00006	.....	.....	
17,000	17,000	.00082	.00006	.....	.....	
18,000	18,000	.00088	.00006	.....	.....	
19,000	19,000	.00094	.00006	.....	.....	
20,000	20,000	.00100	.00006	.00010	.00004	
21,000	21,000	.00106	.00008	.....	.....	
22,000	22,000	.00112	.00004	.....	.....	
23,000	23,000	.00120	.00008	.....	.....	
24,000	24,000	.00128	.00008	.....	.....	
25,000	25,000	.00134	.00006	.00022	.00012	
26,000	26,000	.00144	.00010	.....	.....	
27,000	27,000	.00152	.00008	.....	.....	
28,000	28,000	.00164	.00012	.....	.....	
29,000	29,000	.00174	.00010	.....	.....	
30,000	30,000	.00196	.00022	.00060	.00038	
31,000	31,000	.00212	.00016	.....	.....	
32,000	32,000	.00230	.00018	.....	.....	
33,000	33,000	.00246	.00016	.....	.....	
34,000	34,000	.00264	.00018	.....	.....	
35,000	35,000	.00296	.00032	.00130	.00070	
36,000	36,000	.00324	.00028	.....	.....	
37,000	37,000	.00374	.00050	.....	.....	
38,000	38,000	.00412	.00038	.....	.....	
39,000	39,000	.00472	.00060	.....	.....	
40,000	40,000	.00520	.00048	.00326	.00196	
41,000	41,000	.00564	.00044	.....	.....	
42,000	42,000	.00612	.00048	.....	.....	
43,000	43,000	.00654	.00042	.....	.....	
44,000	44,000	.00712	.00058	.....	.....	
45,000	45,000	.00774	.00062	.00576	.00250	
46,000	46,000	.00832	.00058	.....	.....	
47,000	47,000	.00892	.00060	.....	.....	
48,000	48,000	.00946	.00054	.....	.....	
49,000	49,000	.01000	.00054	.....	.....	
50,000	50,000	.01060	.00060	.00802	.00226	
61,500	61,500	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

No. 1039.

Marks, <sup>12</sup>M R<sub>1</sub> T B<sub>1</sub>  
<sup>M 1<sub>1</sub></sup>

Length, 10<sup>1</sup>/<sub>2</sub>.

Diameter, 1<sup>1</sup>/<sub>2</sub>.129.

Sectional area, 1 square inch.

Gauged length, 5<sup>1</sup>/<sub>2</sub>.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.00004	.00004			
3,000	3,000	.00008	.00004			
4,000	4,000	.00012	.00004			
5,000	5,000	.00018	.00006	0.		
6,000	6,000	.00022	.00004			
7,000	7,000	.00028	.00006			
8,000	8,000	.00032	.00004			
9,000	9,000	.00038	.00006			
10,000	10,000	.00044	.00006	.00002	.00002	
11,000	11,000	.00048	.00004			
12,000	12,000	.00054	.00006			
13,000	13,000	.00060	.00006			
14,000	14,000	.00066	.00006			
15,000	15,000	.00070	.00004	.00004	.00002	
16,000	16,000	.00076	.00006			
17,000	17,000	.00082	.00006			
18,000	18,000	.00088	.00006			
19,000	19,000	.00094	.00006			
20,000	20,000	.00100	.00006	.00010	.00006	
21,000	21,000	.00108	.00008			
22,000	22,000	.00114	.00006			
23,000	23,000	.00122	.00008			
24,000	24,000	.00130	.00008			
25,000	25,000	.00138	.00008	.00022	.00012	
26,000	26,000	.00148	.00010			
27,000	27,000	.00156	.00008			
28,000	28,000	.00168	.00012			
29,000	29,000	.00180	.00012			
30,000	30,000	.00196	.00016	.00054	.00032	
31,000	31,000	.00212	.00016			
32,000	32,000	.00234	.00022			
33,000	33,000	.00260	.00026			
34,000	34,000	.00286	.00026			
35,000	35,000	.00316	.00030	.00142	.00088	
36,000	36,000	.00348	.00032			
37,000	37,000	.00378	.00030			
38,000	38,000	.00422	.00044			
39,000	39,000	.00462	.00040			
40,000	40,000	.00508	.00046	.00310	.00168	
41,000	41,000	.00560	.00052			
42,000	42,000	.00600	.00040			
43,000	43,000	.00648	.00048			
44,000	44,000	.00720	.00072			
45,000	45,000	.00760	.00040	.00534	.00234	
46,000	46,000	.00804	.00044			
47,000	47,000	.00838	.00034			
48,000	48,000	.00868	.00030			
49,000	49,000	.00908	.00040			
50,000	50,000	.00928	.00020	.00602	.00158	
50,800	50,800					Ultimate strength.

Failed by triple flexure.

BODY No. 16.

No. 4606.

Marks, <sup>12 M R M T R,</sup>  
<sub>B T</sub>  
 Diameter, 1".129.  
 Sectional area, 1 square inch.  
 Length of stem, 23".  
 Gauged length, 20".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.000050	.000050	.....	.....	
3,000	3,000	.000105	.000053	.....	.....	
4,000	4,000	.000160	.000055	.....	.....	
5,000	5,000	.000220	.000060	0.	.....	
6,000	6,000	.000285	.000065	.....	.....	
7,000	7,000	.000345	.000060	.....	.....	
8,000	8,000	.000400	.000055	.....	.....	
9,000	9,000	.000460	.000060	.....	.....	
10,000	10,000	.000530	.000070	.000045	.000045	
11,000	11,000	.000600	.000070	.....	.....	
12,000	12,000	.000670	.000070	.000060	.000015	
13,000	13,000	.000750	.000080	.....	.....	
14,000	14,000	.000825	.000075	.000100	.000040	
15,000	15,000	.000915	.000090	.....	.....	
16,000	16,000	.001005	.000090	.000150	.000050	
17,000	17,000	.001105	.000100	.....	.....	
18,000	18,000	.001215	.000110	.000225	.000075	
19,000	19,000	.001340	.000125	.....	.....	
20,000	20,000	.001475	.000135	.000355	.000130	
21,000	21,000	.001650	.000175	.....	.....	
22,000	22,000	.001850	.000200	.000575	.000220	
23,000	23,000	.002175	.000325	.....	.....	
23,380	23,380	.....	.....	.....	.....	Tensile strength.

Fractured 3 3/4" from neck. Appearance, uniform, granular.

No. 4607.

Marks, <sup>12 M R, T R,</sup>  
<sub>M T</sub>  
 Diameter, 1".129.  
 Sectional area, 1 square inch.  
 Length of stem, 23".  
 Gauged length, 20".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.000045	.000045			
3,000	3,000	.000085	.000050			
4,000	4,000	.000145	.000050			
5,000	5,000	.000195	.000050			
6,000	6,000	.000245	.000050	0.		
7,000	7,000	.000300	.000055			
8,000	8,000	.000350	.000050			
9,000	9,000	.000405	.000055			
10,000	10,000	.000460	.000055	.000015	.000015	
11,000	11,000	.000525	.000065			
12,000	12,000	.000590	.000065	.000040	.000025	
13,000	13,000	.000645	.000055			
14,000	14,000	.000700	.000055	.000050	.000010	
15,000	15,000	.000775	.000075			
16,000	16,000	.000850	.000075	.000065	.000015	
17,000	17,000	.000920	.000070			
18,000	18,000	.000990	.000070	.000105	.000040	
19,000	19,000	.001070	.000080			
20,000	20,000	.001155	.000085	.000170	.000065	
21,000	21,000	.001250	.000095			
22,000	22,000	.001365	.000115	.000240	.000070	
23,000	23,000	.001490	.000125			
24,000	24,000	.001620	.000130	.000360	.000120	
25,000	25,000	.001800	.000180	.000460	.000100	
29,710	29,710					Tensile strength.

Fractured at the neck. Appearance, uniform, granular.

No. 1016.

Marks, <sup>12 M R<sub>1</sub> T R<sub>2</sub></sup>  
<sub>B 1<sub>2</sub></sub>  
 Length, 10''<sup>5</sup>.  
 Diameter, 1''<sup>129</sup>.  
 Sectional area, 1 square inch.  
 Gauged length, 5''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.00004	.00004			
3,000	3,000	.00010	.00006			
4,000	4,000	.00014	.00004			
5,000	5,000	.00018	.00004	0.		
6,000	6,000	.00022	.00004			
7,000	7,000	.00028	.00006			
8,000	8,000	.00034	.00006			
9,000	9,000	.00040	.00006			
10,000	10,000	.00044	.00004	.00002	.00002	
11,000	11,000	.00050	.00006			
12,000	12,000	.00056	.00006			
13,000	13,000	.00060	.00004			
14,000	14,000	.00066	.00006			
15,000	15,000	.00072	.00006	.00004	.00002	
16,000	16,000	.00078	.00006			
17,000	17,000	.00084	.00006			
18,000	18,000	.00092	.00008			
19,000	19,000	.00098	.00006			
20,000	20,000	.00106	.00008	.00008	.00004	
21,000	21,000	.00114	.00008			
22,000	22,000	.00122	.00008			
23,000	23,000	.00128	.00006			
24,000	24,000	.00134	.00006			
25,000	25,000	.00144	.00010	.00024	.00016	
26,000	26,000	.00158	.00014			
27,000	27,000	.00168	.00010			
28,000	28,000	.00182	.00014			
29,000	29,000	.00194	.00012			
30,000	30,000	.00212	.00018	.00060	.00036	
31,000	31,000	.00238	.00026			
32,000	32,000	.00256	.00018			
33,000	33,000	.00280	.00024			
34,000	34,000	.00310	.00030			
35,000	35,000	.00348	.00038	.00160	.00100	
36,000	36,000	.00390	.00042			
37,000	37,000	.00430	.00040			
38,000	38,000	.00472	.00042			
39,000	39,000	.00520	.00048			
40,000	40,000	.00578	.00058	.00360	.00200	
41,000	41,000	.00630	.00052			
42,000	42,000	.00684	.00054			
43,000	43,000	.00734	.00050			
44,000	44,000	.00792	.00058			
45,000	45,000	.00870	.00078	.00630	.00270	
46,000	46,000	.00930	.00080			
47,000	47,000	.00980	.00050			
48,000	48,000	.01038	.00058			
49,000	49,000	.01124	.00086			
50,000	50,000	.01204	.00080	.00010	.00310	
57,700	57,700					Ultimate strength.

Failed by triple flexure.

No. 4607.

Marks, <sup>12 M R, T R,</sup>  
<sub>M T,</sub>  
 Diameter, 1".129.  
 Sectional area, 1 square inch.  
 Length of stem, 23".  
 Gauged length, 20".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.000045	.000045	.....	.....	
3,000	3,000	.000095	.000050	.....	.....	
4,000	4,000	.000145	.000050	.....	.....	
5,000	5,000	.000195	.000050	0.	.....	
6,000	6,000	.000245	.000050	.....	.....	
7,000	7,000	.000300	.000055	.....	.....	
8,000	8,000	.000350	.000050	.....	.....	
9,000	9,000	.000405	.000055	.....	.....	
10,000	10,000	.000460	.000055	.000015	.000015	
11,000	11,000	.000525	.000065	.....	.....	
12,000	12,000	.000590	.000065	.000040	.000025	
13,000	13,000	.000645	.000065	.....	.....	
14,000	14,000	.000700	.000065	.000050	.000010	
15,000	15,000	.000775	.000075	.....	.....	
16,000	16,000	.000850	.000075	.000065	.000015	
17,000	17,000	.000920	.000070	.....	.....	
18,000	18,000	.000990	.000070	.000105	.000040	
19,000	19,000	.001070	.000080	.....	.....	
20,000	20,000	.001155	.000085	.000170	.000065	
21,000	21,000	.001250	.000095	.....	.....	
22,000	22,000	.001305	.000115	.000240	.000070	
23,000	23,000	.001490	.000125	.....	.....	
24,000	24,000	.001620	.000130	.000360	.000120	
25,000	25,000	.001800	.000180	.000460	.000100	
29,710	29,710	.....	.....	.....	.....	Tensile strength.

Fractured at the neck. Appearance, uniform, granular.

No. 1016.

Marks, <sup>12 M R<sub>14</sub> T R<sub>2</sub></sup>  
<sub>B F<sub>2</sub></sub>  
 Length, 10''<sup>5</sup>.  
 Diameter, 1''<sup>.129</sup>.  
 Sectional area, 1 square inch.  
 Gauged length, 5''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.00004	.00004	.....	.....	
3,000	3,000	.00010	.00006	.....	.....	
4,000	4,000	.00014	.00004	.....	.....	
5,000	5,000	.00018	.00004	0.	.....	
6,000	6,000	.00022	.00004	.....	.....	
7,000	7,000	.00028	.00006	.....	.....	
8,000	8,000	.00034	.00006	.....	.....	
9,000	9,000	.00040	.00006	.....	.....	
10,000	10,000	.00044	.00004	.00002	.00002	
11,000	11,000	.00050	.00006	.....	.....	
12,000	12,000	.00056	.00006	.....	.....	
13,000	13,000	.00060	.00004	.....	.....	
14,000	14,000	.00066	.00006	.....	.....	
15,000	15,000	.00072	.00006	.00004	.00002	
16,000	16,000	.00078	.00006	.....	.....	
17,000	17,000	.00084	.00006	.....	.....	
18,000	18,000	.00092	.00008	.....	.....	
19,000	19,000	.00098	.00006	.....	.....	
20,000	20,000	.00106	.00008	.00008	.00004	
21,000	21,000	.00114	.00008	.....	.....	
22,000	22,000	.00122	.00008	.....	.....	
23,000	23,000	.00128	.00008	.....	.....	
24,000	24,000	.00134	.00008	.....	.....	
25,000	25,000	.00144	.00010	.00024	.00016	
26,000	26,000	.00158	.00014	.....	.....	
27,000	27,000	.00168	.00010	.....	.....	
28,000	28,000	.00182	.00014	.....	.....	
29,000	29,000	.00194	.00012	.....	.....	
30,000	30,000	.00212	.00018	.00060	.00036	
31,000	31,000	.00238	.00026	.....	.....	
32,000	32,000	.00256	.00018	.....	.....	
33,000	33,000	.00280	.00024	.....	.....	
34,000	34,000	.00310	.00030	.....	.....	
35,000	35,000	.00348	.00038	.00100	.00100	
36,000	36,000	.00390	.00042	.....	.....	
37,000	37,000	.00430	.00040	.....	.....	
38,000	38,000	.00472	.00042	.....	.....	
39,000	39,000	.00520	.00048	.....	.....	
40,000	40,000	.00578	.00058	.00360	.00200	
41,000	41,000	.00630	.00052	.....	.....	
42,000	42,000	.00684	.00054	.....	.....	
43,000	43,000	.00734	.00050	.....	.....	
44,000	44,000	.00792	.00058	.....	.....	
45,000	45,000	.00870	.00078	.00630	.00270	
46,000	46,000	.00930	.00060	.....	.....	
47,000	47,000	.00980	.00050	.....	.....	
48,000	48,000	.01038	.00058	.....	.....	
49,000	49,000	.01124	.00086	.....	.....	
50,000	50,000	.01204	.00080	.00940	.00310	
57,700	57,700	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

No. 1017.

Marks, <sup>12 M R<sub>10</sub> T R<sub>3</sub></sup>  
<sup>B R<sub>10</sub></sup>  
 Length, 10' .5.  
 Diameter, 1" .129.  
 Sectional area, 1 square inch.  
 Gauged length, 5'.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.00004	.00004	.....	.....	
3,000	3,000	.00010	.00006	.....	.....	
4,000	4,000	.00016	.00006	.....	.....	
5,000	5,000	.00020	.00004	.00002	.00002	
6,000	6,000	.00026	.00006	.....	.....	
7,000	7,000	.00032	.00006	.....	.....	
8,000	8,000	.00038	.00006	.....	.....	
9,000	9,000	.00042	.00004	.....	.....	
10,000	10,000	.00048	.00006	.00006	.00004	
11,000	11,000	.00054	.00006	.....	.....	
12,000	12,000	.00060	.00006	.....	.....	
13,000	13,000	.00066	.00006	.....	.....	
14,000	14,000	.00072	.00006	.....	.....	
15,000	15,000	.00078	.00006	.00010	.00004	
16,000	16,000	.00084	.00006	.....	.....	
17,000	17,000	.00090	.00006	.....	.....	
18,000	18,000	.00096	.00006	.....	.....	
19,000	19,000	.00102	.00006	.....	.....	
20,000	20,000	.00110	.00008	.00014	.00004	
21,000	21,000	.00118	.00008	.....	.....	
22,000	22,000	.00124	.00006	.....	.....	
23,000	23,000	.00132	.00008	.....	.....	
24,000	24,000	.00140	.00108	.....	.....	
25,000	25,000	.00148	.00008	.00026	.00012	
26,000	26,000	.00160	.00012	.....	.....	
27,000	27,000	.00170	.00010	.....	.....	
28,000	28,000	.00182	.00012	.....	.....	
29,000	29,000	.00194	.00012	.....	.....	
30,000	30,000	.00212	.00018	.00060	.00034	
32,000	32,000	.00232	.00020	.....	.....	
33,000	33,000	.00250	.00018	.....	.....	
34,000	34,000	.00274	.00024	.....	.....	
35,000	35,000	.00304	.00030	.....	.....	
36,000	36,000	.00340	.00036	.00164	.00104	
37,000	37,000	.00370	.00050	.....	.....	
38,000	38,000	.00416	.00046	.....	.....	
39,000	39,000	.00464	.00048	.....	.....	
40,000	40,000	.00514	.00050	.....	.....	
41,000	41,000	.00554	.00040	.00344	.00180	
42,000	42,000	.00600	.00046	.....	.....	
43,000	43,000	.00664	.00064	.....	.....	
44,000	44,000	.00710	.00046	.....	.....	
45,000	45,000	.00752	.00042	.....	.....	
46,000	46,000	.00824	.00072	.00580	.00236	
47,000	47,000	.00872	.00048	.....	.....	
48,000	48,000	.00916	.00044	.....	.....	
49,000	49,000	.00980	.00064	.....	.....	
50,000	50,000	.01012	.00082	.....	.....	
50,380	50,380	.01078	.00066	.00820	.00240	
		.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.



No. 1018.

Marks, <sup>12</sup>M R<sub>1</sub> T R<sub>1</sub>  
<sup>M T<sub>1</sub></sup>  
 Length, 10''<sup>5</sup>.  
 Diameter, 1''<sup>129</sup>.  
 Sectional area, 1 square inch.  
 Gauged length, 5''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.00006	.00006	.....	.....	
3,000	3,000	.00010	.00004	.....	.....	
4,000	4,000	.00014	.00004	.....	.....	
5,000	5,000	.00018	.00004	0.	.....	
6,000	6,000	.00022	.00004	.....	.....	
7,000	7,000	.00026	.00004	.....	.....	
8,000	8,000	.00030	.00004	.....	.....	
9,000	9,000	.00036	.00006	.....	.....	
10,000	10,000	.00040	.00004	.00004	.00001	
11,000	11,000	.00046	.00006	.....	.....	
12,000	12,000	.00054	.00008	.....	.....	
13,000	13,000	.00060	.00006	.....	.....	
14,000	14,000	.00064	.00004	.....	.....	
15,000	15,000	.00068	.00004	.00008	.00004	
16,000	16,000	.00078	.00010	.....	.....	
17,000	17,000	.00084	.00006	.....	.....	
18,000	18,000	.00090	.00006	.....	.....	
19,000	19,000	.00094	.00004	.....	.....	
20,000	20,000	.00100	.00006	.00012	.00004	
21,000	21,000	.00108	.00008	.....	.....	
22,000	22,000	.00114	.00006	.....	.....	
23,000	23,000	.00120	.00006	.....	.....	
24,000	24,000	.00128	.00008	.....	.....	
25,000	25,000	.00134	.00006	.00020	.00008	
26,000	26,000	.00146	.00012	.....	.....	
27,000	27,000	.00156	.00010	.....	.....	
28,000	28,000	.00164	.00008	.....	.....	
29,000	29,000	.00180	.00016	.....	.....	
30,000	30,000	.00194	.00014	.00050	.00030	
31,000	31,000	.00208	.00014	.....	.....	
32,000	32,000	.00226	.00019	.....	.....	
33,000	33,000	.00248	.00022	.....	.....	
34,000	34,000	.00268	.00020	.....	.....	
35,000	35,000	.00300	.00032	.00130	.00080	
36,000	36,000	.00322	.00022	.....	.....	
37,000	37,000	.00350	.00028	.....	.....	
38,000	38,000	.00400	.00050	.....	.....	
39,000	39,000	.00464	.00064	.....	.....	
40,000	40,000	.00518	.00054	.00320	.00190	
41,000	41,000	.00580	.00062	.....	.....	
42,000	42,000	.00620	.00040	.....	.....	
43,000	43,000	.00680	.00080	.....	.....	
44,000	44,000	.00744	.00084	.....	.....	
45,000	45,000	.00804	.00060	.00576	.00256	
46,000	46,000	.00900	.00096	.....	.....	
47,000	47,000	.00930	.00030	.....	.....	
48,000	48,000	.01038	.00108	.....	.....	
49,000	49,000	.01124	.00086	.....	.....	
50,000	50,000	.01248	.00124	.00970	.00394	
58,440	58,440	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

## BODY No. 16 (second casting).

No. 4671.

Marks, <sup>13 M R, T R,</sup>  
<sub>B T,</sub>

Diameter, 1".129.

Sectional area, 1 square inch.

Length of stem, 23".

Gauged length, 20".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.000050	.000050	.....	.....	
3,000	3,000	.000100	.000050	.....	.....	
4,000	4,000	.000150	.000050	.....	.....	
5,000	5,000	.000200	.000050	0.	.....	
6,000	6,000	.000250	.000050	.....	.....	
7,000	7,000	.000300	.000050	.....	.....	
8,000	8,000	.000350	.000050	.....	.....	
9,000	9,000	.000425	.000050	.....	.....	
10,000	10,000	.000485	.000050	.000025	.000025	
11,000	11,000	.000545	.000050	.....	.....	
12,000	12,000	.000605	.000050	.000045	.000020	
13,000	13,000	.000680	.000075	.....	.....	
14,000	14,000	.000750	.000070	.000065	.000020	
15,000	15,000	.000835	.000085	.....	.....	
16,000	16,000	.000905	.000070	.000100	.000035	
17,000	17,000	.000990	.000085	.....	.....	
18,000	18,000	.001090	.000100	.000160	.000060	
19,000	19,000	.001190	.000100	.....	.....	
20,000	20,000	.001300	.000110	.000250	.000090	
21,000	21,000	.001440	.000140	.....	.....	
22,000	22,000	.001590	.000150	.000395	.000145	
23,000	23,000	.001755	.000165	.....	.....	
24,000	24,000	.001950	.000195	.000615	.000220	
25,000	25,000	.002250	.000300	.000810	.000195	
26,780	26,780	.....	.....	.....	.....	Tensile strength.

Fractured 7".3 from neck. Appearance, granular.

No. 4672.

Marks, 12 M R<sub>1</sub> T R<sub>1</sub>  
 Diameter, 1<sup>11</sup>/<sub>16</sub> 129.  
 Sectional area, 1 square inch.  
 Length of stem, 23".  
 Gauged length, 20".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.000050	.000050	.....	.....	
3,000	3,000	.000100	.000050	.....	.....	
4,000	4,000	.000150	.000050	.....	.....	
5,000	5,000	.000200	.000050	0.	.....	
6,000	6,000	.000250	.000050	.....	.....	
7,000	7,000	.000305	.000055	.....	.....	
8,000	8,000	.000360	.000055	.....	.....	
9,000	9,000	.000410	.000050	.....	.....	
10,000	10,000	.000465	.000055	.000020	.000020	
11,000	11,000	.000540	.000075	.....	.....	
12,000	12,000	.000600	.000080	.000040	.000020	
13,000	13,000	.000655	.000055	.....	.....	
14,000	14,000	.000725	.000070	.000060	.000020	
15,000	15,000	.000800	.000075	.....	.....	
16,000	16,000	.000860	.000060	.000095	.000035	
17,000	17,000	.000945	.000085	.....	.....	
18,000	18,000	.001030	.000085	.000140	.000045	
19,000	19,000	.001105	.000075	.....	.....	
20,000	20,000	.001200	.000095	.000200	.000060	
21,000	21,000	.001310	.000110	.....	.....	
22,000	22,000	.001425	.000115	.000305	.000105	
23,000	23,000	.001595	.000170	.....	.....	
24,000	24,000	.001750	.000155	.000500	.000185	
25,000	25,000	.001945	.000195	.000605	.000105	
27,040	27,040	.....	.....	.....	.....	

Fractured at the neck. Appearance, granular.

No. 1042.

Marks,  $12 M R_{11} T R_2$   
 $B T_{11}$ 

Length, 10'.5.

Diameter, 1".129.

Sectional area, 1 square inch.

Gauged length, 5'.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.00006	.00006	.....	.....	
3,000	3,000	.00010	.00010	.....	.....	
4,000	4,000	.00014	.00014	.....	.....	
5,000	5,000	.00018	.00018	.....	.....	
6,000	6,000	.00022	.00022	.....	.....	
7,000	7,000	.00028	.00028	.....	.....	
8,000	8,000	.00034	.00034	.....	.....	
9,000	9,000	.00040	.00040	.....	.....	
10,000	10,000	.00046	.00046	.00002	.00002	
11,000	11,000	.00052	.00052	.....	.....	
12,000	12,000	.00056	.00056	.....	.....	
13,000	13,000	.00060	.00060	.....	.....	
14,000	14,000	.00066	.00066	.....	.....	
15,000	15,000	.00072	.00072	.00006	.00006	
16,000	16,000	.00078	.00078	.....	.....	
17,000	17,000	.00086	.00086	.....	.....	
18,000	18,000	.00090	.00090	.....	.....	
19,000	19,000	.00096	.00096	.....	.....	
20,000	20,000	.00102	.00102	.00012	.00004	
21,000	21,000	.00110	.00110	.....	.....	
22,000	22,000	.00114	.00114	.....	.....	
23,000	23,000	.00120	.00120	.....	.....	
24,000	24,000	.00128	.00128	.....	.....	
25,000	25,000	.00138	.00138	.00022	.00010	
26,000	26,000	.00144	.00144	.....	.....	
27,000	27,000	.00152	.00152	.....	.....	
28,000	28,000	.00162	.00162	.....	.....	
29,000	29,000	.00174	.00174	.....	.....	
30,000	30,000	.00188	.00188	.00050	.00028	
31,000	31,000	.00202	.00202	.....	.....	
32,000	32,000	.00218	.00218	.....	.....	
33,000	33,000	.00236	.00236	.....	.....	
34,000	34,000	.00260	.00260	.....	.....	
35,000	35,000	.00292	.00292	.00130	.00080	
36,000	36,000	.00322	.00322	.....	.....	
37,000	37,000	.00352	.00352	.....	.....	
38,000	38,000	.00392	.00392	.....	.....	
39,000	39,000	.00432	.00432	.....	.....	
40,000	40,000	.00490	.00490	.00298	.00168	
41,000	41,000	.00528	.00528	.....	.....	
42,000	42,000	.00574	.00574	.....	.....	
43,000	43,000	.00630	.00630	.....	.....	
44,000	44,000	.00686	.00686	.....	.....	
45,000	45,000	.00738	.00738	.00512	.00214	
46,000	46,000	.00786	.00786	.....	.....	
47,000	47,000	.00850	.00850	.....	.....	
48,000	48,000	.00900	.00900	.....	.....	
49,000	49,000	.00940	.00940	.....	.....	
50,000	50,000	.01022	.00982	.00770	.00258	
63,400	63,400	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

No. 1043.

Marks, <sup>12 M R<sub>10</sub> T R<sub>2</sub></sup>  
<sub>B R<sub>20</sub></sub>  
 Length, 10''<sup>5</sup>.  
 Diameter, 1''<sup>129</sup>.  
 Sectional area, 1 square inch.  
 Gauged length, 5''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0.	0.	0.		
2,000	2,000	.00004	.00004	.....	.....		
3,000	3,000	.00010	.00006	.....	.....		
4,000	4,000	.00014	.00004	.....	.....		
5,000	5,000	.00020	.00006	0.	.....		
6,000	6,000	.00024	.00004	.....	.....		
7,000	7,000	.00030	.00006	.....	.....		
8,000	8,000	.00034	.00004	.....	.....		
9,000	9,000	.00040	.00006	.....	.....		
10,000	10,000	.00044	.00004	.00002	.00002		
11,000	11,000	.00050	.00006	.....	.....		
12,000	12,000	.00056	.00006	.....	.....		
13,000	13,000	.00060	.00004	.....	.....		
14,000	14,000	.00066	.00006	.....	.....		
15,000	15,000	.00070	.00004	.00008	.00006		
16,000	16,000	.00076	.00006	.....	.....		
17,000	17,000	.00080	.00004	.....	.....		
18,000	18,000	.00088	.00008	.....	.....		
19,000	19,000	.00092	.00004	.....	.....		
20,000	20,000	.00098	.00006	.00010	.00002		
21,000	21,000	.00104	.00006	.....	.....		
22,000	22,000	.00112	.00008	.....	.....		
23,000	23,000	.00120	.00008	.....	.....		
24,000	24,000	.00126	.00006	.....	.....		
25,000	25,000	.00132	.00006	.00020	.00010		
26,000	26,000	.00140	.00008	.....	.....		
27,000	27,000	.00150	.00010	.....	.....		
28,000	28,000	.00158	.00008	.....	.....		
29,000	29,000	.00170	.00012	.....	.....		
30,000	30,000	.00184	.00014	.00046	.00026		
31,000	31,000	.00200	.00016	.....	.....		
32,000	32,000	.00212	.00012	.....	.....		
33,000	33,000	.00232	.00020	.....	.....		
34,000	34,000	.00260	.00028	.....	.....		
35,000	35,000	.00290	.00030	.00126	.00080		
36,000	36,000	.00328	.00036	.....	.....		
37,000	37,000	.00360	.00032	.....	.....		
38,000	38,000	.00400	.00040	.....	.....		
39,000	39,000	.00444	.00044	.....	.....		
40,000	40,000	.00482	.00038	.00294	.00168		
41,000	41,000	.00520	.00038	.....	.....		
42,000	42,000	.00572	.00052	.....	.....		
43,000	43,000	.00620	.00048	.....	.....		
44,000	44,000	.00676	.00056	.....	.....		
45,000	45,000	.00738	.00062	.00516	.00222		
46,000	46,000	.00792	.00054	.....	.....		
47,000	47,000	.00838	.00048	.....	.....		
48,000	48,000	.00890	.00052	.....	.....		
49,000	49,000	.00940	.00050	.....	.....		
50,000	50,000	.01004	.00064	.00756	.00240		
63,500	63,500	.....	.....	.....	.....		Ultimate strength.

Failed by triple flexure.

No. 1044.

Marks, <sup>12</sup>M R<sub>16</sub> T R<sub>1</sub>,<sup>M</sup>T<sub>12</sub>Length, 10<sup>1</sup>/<sub>5</sub>.Diameter, 1<sup>1</sup>/<sub>129</sub>.

Sectional area, 1 square inch.

Gauged length, 5<sup>1</sup>/<sub>1</sub>.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.		
1,000	1,000	0.	0.	0.	0	Initial load.	
2,000	2,000	.00004	.00004	.....	.....		
3,000	3,000	.00010	.00006	.....	.....		
4,000	4,000	.00014	.00004	.....	.....		
5,000	5,000	.00018	.00004	0.	.....		
6,000	6,000	.00022	.00004	.....	.....		
7,000	7,000	.00028	.00006	.....	.....		
8,000	8,000	.00032	.00004	.....	.....		
9,000	9,000	.00038	.00006	.....	.....		
10,000	10,000	.00042	.00004	.00002	.00002		
11,000	11,000	.00048	.00006	.....	.....		
12,000	12,000	.00052	.00004	.....	.....		
13,000	13,000	.00058	.00006	.....	.....		
14,000	14,000	.00062	.00004	.....	.....		
15,000	15,000	.00068	.00006	.00008	.00006		
16,000	16,000	.00074	.00006	.....	.....		
17,000	17,000	.00080	.00006	.....	.....		
18,000	18,000	.00084	.00004	.....	.....		
19,000	19,000	.00090	.00006	.....	.....		
20,000	20,000	.00096	.00006	.00012	.00004		
21,000	21,000	.00102	.00006	.....	.....		
22,000	22,000	.00108	.00006	.....	.....		
23,000	23,000	.00114	.00006	.....	.....		
24,000	24,000	.00120	.00006	.....	.....		
25,000	25,000	.00128	.00008	.00020	.00008		
26,000	26,000	.00136	.00008	.....	.....		
27,000	27,000	.00146	.00010	.....	.....		
28,000	28,000	.00154	.00008	.....	.....		
29,000	29,000	.00162	.00008	.....	.....		
30,000	30,000	.00170	.00008	.00040	.00020		
31,000	31,000	.00182	.00022	.....	.....		
32,000	32,000	.00200	.00008	.....	.....		
33,000	33,000	.00214	.00014	.....	.....		
34,000	34,000	.00236	.00022	.....	.....		
35,000	35,000	.00258	.00022	.00096	.00056		
36,000	36,000	.00280	.00022	.....	.....		
37,000	37,000	.00310	.00030	.....	.....		
38,000	38,000	.00348	.00038	.....	.....		
39,000	39,000	.00392	.00044	.....	.....		
40,000	40,000	.00440	.00048	.00252	.00156		
41,000	41,000	.00488	.00048	.....	.....		
42,000	42,000	.00524	.00036	.....	.....		
43,000	43,000	.00560	.00036	.....	.....		
44,000	44,000	.00612	.00052	.....	.....		
45,000	45,000	.00680	.00068	.00464	.00212		
46,000	46,000	.00720	.00040	.....	.....		
47,000	47,000	.00756	.00036	.....	.....		
48,000	48,000	.00804	.00048	.....	.....		
49,000	49,000	.00840	.00036	.....	.....		
50,000	50,000	.00900	.00060	.00662	.00198		
62,760	62,760	.....	.....	.....	.....		Ultimate strength.

Failed by triple flexure.

## BODY No. 17.

No. 4610.

Marks, <sup>12 M R<sub>17</sub> T R<sub>2</sub></sup><sub>B T<sub>1</sub></sub>

Diameter, 1".129.

Sectional area, 1 square inch.

Length of stem, 23".

Gauged length, 20".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.000055	.000055			
3,000	3,000	.000105	.000050			
4,000	4,000	.000160	.000035			
5,000	5,000	.000210	.000050	.000010	.000010	
6,000	6,000	.000275	.000005			
7,000	7,000	.000340	.000005			
8,000	8,000	.000395	.000055			
9,000	9,000	.000450	.000055			
10,000	10,000	.000505	.000055	.000035	.000025	
11,000	11,000	.000570	.000065			
12,000	12,000	.000640	.000070	.000055	.000020	
13,000	13,000	.000710	.000070			
14,000	14,000	.000790	.000080	.000090	.000035	
15,000	15,000	.000865	.000075			
16,000	16,000	.000950	.000085	.000125	.000035	
26,000	26,000	.003100	.002150	.001580	.001435	
26,820	26,820					Tensile strength.

Fractured 4" from neck. Appearance, granular.

H. Ex. 43—15

No. 4611.

Marks, 12 M R, T R,  
M T<sub>1</sub>

Diameter, 1".129.

Sectional area, 1 square inch.

Length of stem, 23".

Gauged length, 20".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0.	0.	0.		
2,000	2,000	.000050	.000050				
3,000	3,000	.000100	.000050				
4,000	4,000	.000140	.000040				
5,000	5,000	.000185	.000045	.000005	.000005		
6,000	6,000	.000235	.000050				
7,000	7,000	.000285	.000050				
8,000	8,000	.000340	.000055				
9,000	9,000	.000390	.000050				
10,000	10,000	.000440	.000050	.000010	.000005		
11,000	11,000	.000495	.000055				
12,000	12,000	.000550	.000055	.000015	.000005		
13,000	13,000	.000605	.000055				
14,000	14,000	.000655	.000050	.000035	.000020		
15,000	15,000	.000715	.000060				
16,000	16,000	.000775	.000060	.000045	.000010		
17,000	17,000	.000845	.000070				
18,000	18,000	.000910	.000065	.000075	.000030		
19,000	19,000	.000985	.000075				
20,000	20,000	.001060	.000075	.000105	.000030		
21,000	21,000	.001150	.000090				
22,000	22,000	.001225	.000075	.000100	.000055		
23,000	23,000	.001340	.000115				
24,000	24,000	.001440	.000100	.000245	.000085		
25,000	25,000	.001575	.000135	.000325	.000060		
28,890	28,890						Tensile strength.

Fractured at neck. Appearance, granular.



No. 1019.

Marks, <sup>12</sup>M<sub>B</sub><sup>17</sup>T<sub>3</sub><sup>2</sup>  
 Length, 10''<sup>5</sup>.  
 Diameter, 1''<sup>.129</sup>.  
 Sectional area, 1 square inch.  
 Gauged length, 5''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0.	0.	0.		
2,000	2,000	.00004	.00004				
3,000	3,000	.00008	.00004				
4,000	4,000	.00012	.00004				
5,000	5,000	.00018	.00008	0.			
6,000	6,000	.00024	.00008				
7,000	7,000	.00030	.00008				
8,000	8,000	.00036	.00008				
9,000	9,000	.00042	.00008				
10,000	10,000	.00048	.00008	.00002	.00002		
11,000	11,000	.00054	.00008				
12,000	12,000	.00060	.00008				
13,000	13,000	.00064	.00004				
14,000	14,000	.00068	.00004				
15,000	15,000	.00074	.00008	.00004	.00002		
16,000	16,000	.00078	.00004				
17,000	17,000	.00082	.00004				
18,000	18,000	.00090	.00008				
19,000	19,000	.00094	.00004				
20,000	20,000	.00100	.00008	.00010	.00008		
21,000	21,000	.00108	.00008				
22,000	22,000	.00112	.00008				
23,000	23,000	.00120	.00008				
24,000	24,000	.00130	.00010				
25,000	25,000	.00140	.00010	.00020	.00010		
26,000	26,000	.00148	.00008				
27,000	27,000	.00154	.00008				
28,000	28,000	.00164	.00010				
29,000	29,000	.00180	.00016				
30,000	30,000	.00198	.00016	.00050	.00030		
31,000	31,000	.00212	.00016				
32,000	32,000	.00230	.00018				
33,000	33,000	.00244	.00014				
34,000	34,000	.00274	.00020				
35,000	35,000	.00300	.00026	.00128	.00078		
36,000	36,000	.00328	.00028				
37,000	37,000	.00366	.00038				
38,000	38,000	.00404	.00038				
39,000	39,000	.00450	.00046				
40,000	40,000	.00500	.00050	.00290	.00162		
41,000	41,000	.00524	.00024				
42,000	42,000	.00568	.00042				
43,000	43,000	.00628	.00062				
44,000	44,000	.00670	.00042				
45,000	45,000	.00732	.00062	.00500	.00210		
46,000	46,000	.00780	.00048				
47,000	47,000	.00818	.00038				
48,000	48,000	.00870	.00052				
49,000	49,000	.00920	.00050				
50,000	50,000	.00978	.00058	.00720	.00220		
62,000	62,000						Ultimate strength.

Failed by triple flexure.

No. 1020.

Marks, <sup>12 M R<sub>11</sub>, T R<sub>2</sub></sup>  
<sup>B R<sub>10</sub></sup>  
 Length, 10''<sup>5</sup>.  
 Diameter, 1''<sup>.129</sup>.  
 Sectional area, 1 square inch.  
 Gauged length, 5''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0.	0.	0.		
2,000	2,000	.00004	.00004	.....	.....		
3,000	3,000	.00010	.00006	.....	.....		
4,000	4,000	.00014	.00004	.....	.....		
5,000	5,000	.00018	.00004	0.	.....		
6,000	6,000	.00024	.00006	.....	.....		
7,000	7,000	.00030	.00006	.....	.....		
8,000	8,000	.00036	.00006	.....	.....		
9,000	9,000	.00040	.00004	.....	.....		
10,000	10,000	.00044	.00004	.00004	.00004		
11,000	11,000	.00052	.00008	.....	.....		
12,000	12,000	.00056	.00004	.....	.....		
13,000	13,000	.00064	.00008	.....	.....		
14,000	14,000	.00070	.00006	.....	.....		
15,000	15,000	.00074	.00004	.00006	.00002		
16,000	16,000	.00078	.00004	.....	.....		
17,000	17,000	.00082	.00004	.....	.....		
18,000	18,000	.00088	.00006	.....	.....		
19,000	19,000	.00094	.00006	.....	.....		
20,000	20,000	.00102	.00008	.00012	.00006		
21,000	21,000	.00106	.00004	.....	.....		
22,000	22,000	.00112	.00006	.....	.....		
23,000	23,000	.00118	.00006	.....	.....		
24,000	24,000	.00126	.00008	.....	.....		
25,000	25,000	.00134	.00008	.00022	.00010		
26,000	26,000	.00144	.00010	.....	.....		
27,000	27,000	.00152	.00008	.....	.....		
28,000	28,000	.00160	.00008	.....	.....		
29,000	29,000	.00172	.00012	.....	.....		
30,000	30,000	.00184	.00012	.00044	.00022		
31,000	31,000	.00204	.00020	.....	.....		
32,000	32,000	.00226	.00022	.....	.....		
33,000	33,000	.00240	.00014	.....	.....		
34,000	34,000	.00268	.00028	.....	.....		
35,000	35,000	.00300	.00032	.00130	.00086		
36,000	36,000	.00324	.00024	.....	.....		
37,000	37,000	.00360	.00036	.....	.....		
38,000	38,000	.00410	.00050	.....	.....		
39,000	39,000	.00446	.00038	.....	.....		
40,000	40,000	.00496	.00050	.00300	.00170		
41,000	41,000	.00548	.00050	.....	.....		
42,000	42,000	.00592	.00044	.....	.....		
43,000	43,000	.00638	.00046	.....	.....		
44,000	44,000	.00684	.00046	.....	.....		
45,000	45,000	.00748	.00064	.00500	.00200		
46,000	46,000	.00800	.00052	.....	.....		
47,000	47,000	.00856	.00056	.....	.....		
48,000	48,000	.00902	.00046	.....	.....		
49,000	49,000	.00970	.00068	.....	.....		
50,000	50,000	.01052	.00082	.00790	.00290		
64,950	64,950	.....	.....	.....	.....		Ultimate strength.

Failed by triple flexure.

No. 1021.

Marks, <sup>12 M R, T R,</sup>  
<sub>M 1,</sub>  
 Length, 10' 5".  
 Diameter, 1" .129.  
 Sectional area, 1 square inch.  
 Gauged length, 5".

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0.	0.	0.		
2,000	2,000	.00006	.00006				
3,000	3,000	.00010	.00004				
4,000	4,000	.00014	.00004				
5,000	5,000	.00020	.00006	0.			
6,000	6,000	.00024	.00004				
7,000	7,000	.00030	.00006				
8,000	8,000	.00034	.00004				
9,000	9,000	.00038	.00004				
10,000	10,000	.00042	.00004	.00002	.00002		
11,000	11,000	.00046	.00004				
12,000	12,000	.00052	.00006				
13,000	13,000	.00058	.00006				
14,000	14,000	.00066	.00008				
15,000	15,000	.00070	.00004	.00006	.00004		
16,000	16,000	.00078	.00008				
17,000	17,000	.00084	.00006				
18,000	18,000	.00090	.00006				
19,000	19,000	.00098	.00008				
20,000	20,000	.00104	.00006	.00010	.00004		
21,000	21,000	.00112	.00008				
22,000	22,000	.00120	.00008				
23,000	23,000	.00126	.00006				
24,000	24,000	.00132	.00006				
25,000	25,000	.00140	.00008	.00020	.00010		
26,000	26,000	.00152	.00012				
27,000	27,000	.00162	.00010				
28,000	28,000	.00174	.00012				
29,000	29,000	.00186	.00012				
30,000	30,000	.00204	.00018	.00052	.00032		
31,000	31,000	.00218	.00014				
32,000	32,000	.00240	.00022				
33,000	33,000	.00202	.00022				
34,000	34,000	.00236	.00024				
35,000	35,000	.00320	.00034	.00142	.00090		
36,000	36,000	.00372	.00052				
37,000	37,000	.00394	.00022				
38,000	38,000	.00444	.00050				
39,000	39,000	.00504	.00080				
40,000	40,000	.00550	.00046	.00340	.00198		
41,000	41,000	.00600	.00050				
42,000	42,000	.00652	.00052				
43,000	43,000	.00704	.00052				
44,000	44,000	.00782	.00078				
45,000	45,000	.00870	.00088	.00020	.00280		
46,000	46,000	.00926	.00056				
47,000	47,000	.00992	.00066				
48,000	48,000	.01072	.00080				
49,000	49,000	.01176	.00104				
50,000	50,000	.01290	.00114	.01000	.00380		
58,000	58,000						Ultimate strength.

Failed by triple flexure.

BODY No. 18.

No. 4612.

Marks, <sup>12 M R<sub>18</sub> T R<sub>3</sub></sup>  
<sub>B T<sub>1</sub></sub>

Diameter, 1".129.

Sectional area, 1 square inch.

Length of stem, 23".

Gauged length, 20".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>		
1,000	1,000	0.	0.	0.	0.	Initial load.	
2,000	2,000	.000055	.000055	.....	.....		
3,000	3,000	.000110	.000055	.....	.....		
4,000	4,000	.000165	.000055	.....	.....		
5,000	5,000	.000215	.000050	0.	.....		
6,000	6,000	.000270	.000055	.....	.....		
7,000	7,000	.000325	.000055	.....	.....		
8,000	8,000	.000380	.000055	.....	.....		
9,000	9,000	.000445	.000065	.....	.....		
10,000	10,000	.000505	.000060	.000035	.000035		
11,000	11,000	.000570	.000065	.....	.....		
12,000	12,000	.000640	.000070	.000060	.000025		
13,000	13,000	.000710	.000070	.....	.....		
14,000	14,000	.000785	.000075	.000095	.000035		
15,000	15,000	.000860	.000075	.....	.....		
16,000	16,000	.000945	.000085	.000140	.000045		
17,000	17,000	.001030	.000085	.....	.....		
18,000	18,000	.001114	.000110	.000200	.000060		
19,000	19,000	.001250	.000110	.....	.....		
20,000	20,000	.001370	.000120	.000300	.000100		
21,000	21,000	.001525	.000155	.....	.....		
22,000	22,000	.001700	.000175	.000475	.000175		
23,000	23,000	.001900	.000200	.....	.....		
24,000	24,000	.002100	.000200	.000740	.000265		
25,000	25,000	.002400	.000300	.000950	.000210		
27,660	27,660	.....	.....	.....	.....		Tensile strength.

Fractured 3".7 from neck. Appearance, granular.

No. 4613.

Marks, <sup>12</sup>M R, T R,  
<sub>M T</sub>  
 Diameter, 1", 129.  
 Sectional area, 1 square inch.  
 Length of stem, 23".  
 Gauged length, 20".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.000050	.000050	.....	.....	
3,000	3,000	.000095	.000045	.....	.....	
4,000	4,000	.000140	.000045	.....	.....	
5,000	5,000	.000190	.000050	0.	.....	
6,000	6,000	.000240	.000050	.....	.....	
7,000	7,000	.000295	.000055	.....	.....	
8,000	8,000	.000345	.000050	.....	.....	
9,000	9,000	.000400	.000055	.....	.....	
10,000	10,000	.000455	.000055	.000015	.000015	
11,000	11,000	.000505	.000050	.....	.....	
12,000	12,000	.000560	.000055	.000030	.000015	
13,000	13,000	.000625	.000065	.....	.....	
14,000	14,000	.000690	.000065	.000045	.000015	
15,000	15,000	.000750	.000080	.....	.....	
16,000	16,000	.000810	.000080	.000065	.000020	
17,000	17,000	.000885	.000075	.....	.....	
18,000	18,000	.000960	.000075	.000095	.000030	
19,000	19,000	.001050	.000090	.....	.....	
20,000	20,000	.001170	.000120	.000150	.000055	
21,000	21,000	.001240	.000070	.....	.....	
22,000	22,000	.001320	.000080	.000225	.000075	
23,000	23,000	.001445	.000125	.....	.....	
24,000	24,000	.001535	.000110	.000350	.000125	
25,000	25,000	.001725	.000170	.000440	.000090	
29,610	29,610	.....	.....	.....	.....	Tensile strength.

Fractured 10".2 from neck. Appearance, granular.

No. 1022.

Marks, <sup>12 M R<sub>10</sub> T R<sub>2</sub></sup>  
<sub>B T<sub>1</sub></sub>  
 Length, 10''<sup>5</sup>.  
 Diameter, 1''<sup>129</sup>.  
 Sectional area, 1 square inch.  
 Gauged length, 5''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0.	0.	0.		
2,000	2,000	.00004	.00004	.....	.....		
3,000	3,000	.00008	.00008	.....	.....		
4,000	4,000	.00012	.00012	.....	.....		
5,000	5,000	.00018	.00018	.....	.....		
6,000	6,000	.00022	.00022	.....	.....		
7,000	7,000	.00028	.00028	.....	.....		
8,000	8,000	.00032	.00032	.....	.....		
9,000	9,000	.00040	.00040	.....	.....		
10,000	10,000	.00046	.00046	.....	.....		
11,000	11,000	.00050	.00050	.....	.....		
12,000	12,000	.00058	.00058	.....	.....		
13,000	13,000	.00064	.00064	.....	.....		
14,000	14,000	.00070	.00070	.....	.....		
15,000	15,000	.00074	.00074	.....	.....		
16,000	16,000	.00080	.00080	.00006	.00004		
17,000	17,000	.00084	.00084	.....	.....		
18,000	18,000	.00088	.00088	.....	.....		
19,000	19,000	.00088	.00088	.....	.....		
20,000	20,000	.00104	.00104	.00010	.00004		
21,000	21,000	.00110	.00110	.....	.....		
22,000	22,000	.00118	.00118	.....	.....		
23,000	23,000	.00126	.00126	.....	.....		
24,000	24,000	.00132	.00132	.....	.....		
25,000	25,000	.00140	.00140	.00024	.00014		
26,000	26,000	.00152	.00152	.....	.....		
27,000	27,000	.00162	.00162	.....	.....		
28,000	28,000	.00172	.00172	.....	.....		
29,000	29,000	.00182	.00182	.....	.....		
30,000	30,000	.00198	.00198	.00056	.00032		
31,000	31,000	.00212	.00212	.....	.....		
32,000	32,000	.00230	.00230	.....	.....		
33,000	33,000	.00254	.00254	.....	.....		
34,000	34,000	.00280	.00280	.....	.....		
35,000	35,000	.00312	.00312	.00140	.00084		
36,000	36,000	.00350	.00350	.....	.....		
37,000	37,000	.00384	.00384	.....	.....		
38,000	38,000	.00424	.00424	.....	.....		
39,000	39,000	.00444	.00444	.....	.....		
40,000	40,000	.00520	.00520	.00320	.00180		
41,000	41,000	.00554	.00554	.....	.....		
42,000	42,000	.00590	.00590	.....	.....		
43,000	43,000	.00650	.00650	.....	.....		
44,000	44,000	.00690	.00690	.....	.....		
45,000	45,000	.00752	.00752	.00530	.00210		
46,000	46,000	.00816	.00816	.....	.....		
47,000	47,000	.00840	.00840	.....	.....		
48,000	48,000	.00870	.00870	.....	.....		
49,000	49,000	.00920	.00920	.....	.....		
50,000	50,000	.00960	.00960	.00700	.00170		
61,100	61,100	.....	.....	.....	.....		Ultimate strength.

Failed by triple flexure.

No. 1023.

Marks,  $12 M R_{10} T R_{10}$   
 $B R_{10}$   
 Length, 10'' .5.  
 Diameter, 1'' .129.  
 Sectional area, 1 square inch.  
 Gauged length, 5''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0.				
2,000	2,000	.00004	.00004				
3,000	3,000	.00010	.00006				
4,000	4,000	.00016	.00006				
5,000	5,000	.00020	.00004	.00004	.00004		
6,000	6,000	.00026	.00006				
7,000	7,000	.00030	.00004				
8,000	8,000	.00034	.00004				
9,000	9,000	.00040	.00006				
10,000	10,000	.00048	.00008	.00006	.00002		
11,000	11,000	.00054	.00006				
12,000	12,000	.00060	.00006				
13,000	13,000	.00066	.00006				
14,000	14,000	.00072	.00006				
15,000	15,000	.00076	.00004	.00010	.00004		
16,000	16,000	.00084	.00008				
17,000	17,000	.00092	.00008				
18,000	18,000	.00098	.00006				
19,000	19,000	.00102	.00004				
20,000	20,000	.00108	.00006	.00018	.00008		
21,000	21,000	.00114	.00006				
22,000	22,000	.00120	.00006				
23,000	23,000	.00128	.00008				
24,000	24,000	.00136	.00008				
25,000	25,000	.00142	.00006	.00030	.00012		
26,000	26,000	.00152	.00010				
27,000	27,000	.00162	.00010				
28,000	28,000	.00170	.00008				
29,000	29,000	.00182	.00012				
30,000	30,000	.00194	.00012	.00056	.00026		
31,000	31,000	.00216	.00022				
32,000	32,000	.00232	.00016				
33,000	33,000	.00254	.00022				
34,000	34,000	.00286	.00032				
35,000	35,000	.00320	.00034	.00150	.00094		
36,000	36,000	.00362	.00042				
37,000	37,000	.00394	.00032				
38,000	38,000	.00436	.00012				
39,000	39,000	.00464	.00028				
40,000	40,000	.00540	.00076	.00344	.00194		
41,000	41,000	.00590	.00050				
42,000	42,000	.00638	.00048				
43,000	43,000	.00674	.00036				
44,000	44,000	.00738	.00064				
45,000	45,000	.00824	.00086	.00590	.00246		
46,000	46,000	.00880	.00056				
47,000	47,000	.00930	.00050				
48,000	48,000	.01010	.00080				
49,000	49,000	.01080	.00070				
50,000	50,000	.01192	.00112	.00920	.00330		
61,280	61,280						Ultimate strength.

Failed by triple flexure.

No. 1024.

Marks, <sup>12 M R<sub>12</sub> T R<sub>1</sub></sup>  
<sub>M T<sub>1</sub></sub>  
 Length, 10''<sup>5</sup>.  
 Diameter, 1''<sup>129</sup>.  
 Sectional area, 1 square inch.  
 Gauged length, 5''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0.	0.	0.		
2,000	2,000	.00006	.00006				
3,000	3,000	.00010	.00004				
4,000	4,000	.00014	.00004				
5,000	5,000	.00018	.00004	.00002	.00002		
6,000	6,000	.00024	.00006				
7,000	7,000	.00028	.00004				
8,000	8,000	.00034	.00008				
9,000	9,000	.00040	.00008				
10,000	10,000	.00046	.00008	.00006	.00004		
11,000	11,000	.00054	.00008				
12,000	12,000	.00060	.00008				
13,000	13,000	.00066	.00008				
14,000	14,000	.00070	.00004				
15,000	15,000	.00076	.00008	.00010	.00004		
16,000	16,000	.00082	.00008				
17,000	17,000	.00088	.00006				
18,000	18,000	.00094	.00006				
19,000	19,000	.00100	.00008				
20,000	20,000	.00106	.00008	.00016	.00008		
21,000	21,000	.00112	.00008				
22,000	22,000	.00120	.00008				
23,000	23,000	.00126	.00006				
24,000	24,000	.00132	.00008				
25,000	25,000	.00140	.00008	.00026	.00010		
26,000	26,000	.00150	.00010				
27,000	27,000	.00160	.00010				
28,000	28,000	.00170	.00010				
29,000	29,000	.00182	.00012				
30,000	30,000	.00196	.00014	.00052	.00026		
31,000	31,000	.00212	.00016				
32,000	32,000	.00230	.00018				
33,000	33,000	.00250	.00020				
34,000	34,000	.00276	.00026				
35,000	35,000	.00302	.00026	.00132	.00080		
36,000	36,000	.00348	.00046				
37,000	37,000	.00380	.00032				
38,000	38,000	.00420	.00040				
39,000	39,000	.00464	.00044				
40,000	40,000	.00520	.00056	.00320	.00188		
41,000	41,000	.00570	.00050				
42,000	42,000	.00596	.00026				
43,000	43,000	.00680	.00064				
44,000	44,000	.00700	.00040				
45,000	45,000	.00750	.00050	.00540	.00220		
46,000	46,000	.00840	.00090				
47,000	47,000	.00898	.00058				
48,000	48,000	.00936	.00038				
49,000	49,000	.01010	.00074				
50,000	50,000	.01080	.00070	.00810	.00270		
60,990	60,990						Ultimate strength.

Failed by triple flexure.



BODY No. 19.

No. 4677.

Marks, <sup>12 M R<sub>1</sub> T R<sub>2</sub></sup>  
<sub>B T<sub>1</sub></sub>

Diameter, 1" .29.

Sectional area, 1 square inch.

Length of stem, 23".

Gauged length, 20".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.000050	.000050	.....	.....	
3,000	3,000	.000100	.000100	.....	.....	
4,000	4,000	.000150	.000150	.....	.....	
5,000	5,000	.000200	.000200	0.	.....	
6,000	6,000	.000250	.000250	.....	.....	
7,000	7,000	.000300	.000300	.....	.....	
8,000	8,000	.000350	.000350	.....	.....	
9,000	9,000	.000410	.000380	.....	.....	
10,000	10,000	.000465	.000455	.000015	.000015	
11,000	11,000	.000535	.000470	.....	.....	
12,000	12,000	.000600	.000605	.000045	.000030	
13,000	13,000	.000670	.000670	.....	.....	
14,000	14,000	.000745	.000675	.000060	.000015	
15,000	15,000	.000820	.000675	.....	.....	
16,000	16,000	.000900	.000680	.000100	.000040	
17,000	17,000	.000995	.000695	.....	.....	
18,000	18,000	.001100	.000705	.000185	.000065	
19,000	19,000	.001200	.000710	.....	.....	
20,000	20,000	.001340	.000740	.000275	.000110	
21,000	21,000	.001495	.000755	.....	.....	
22,000	22,000	.001660	.000765	.000460	.000185	
23,000	23,000	.001850	.000790	.....	.....	
24,000	24,000	.002150	.000830	.000820	.000380	
25,000	25,000	.002440	.000890	.001000	.000180	
26,610	26,610	.....	.....	.....	.....	Tensile strength.

Fractured 4" .8 from neck. Appearance, granular.

No. 4678.

Marks, <sup>12</sup> M R<sub>1</sub> T R<sub>1</sub>Diameter, <sup>M T</sup> 1".129.

Sectional area, 1 square inch.

Length of stem, 23".

Gauged length, 20".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0.	0.	0.		
2,000	2,000	.000350	.000050	.....	.....		
3,000	3,000	.000100	.000050	.....	.....		
4,000	4,000	.000150	.000050	.....	.....		
5,000	5,000	.000200	.000050	0.	.....		
6,000	6,000	.000250	.000050	.....	.....		
7,000	7,000	.000300	.000050	.....	.....		
8,000	8,000	.000350	.000050	.....	.....		
9,000	9,000	.000405	.000055	.....	.....		
10,000	10,000	.000455	.000050	.000015	.000015		
11,000	11,000	.000520	.000065	.....	.....		
12,000	12,000	.000585	.000065	.000045	.000030		
13,000	13,000	.000645	.000069	.....	.....		
14,000	14,000	.000700	.000055	.000055	.000010		
15,000	15,000	.000775	.000075	.....	.....		
16,000	16,000	.000850	.000075	.000095	.000040		
17,000	17,000	.000925	.000079	.....	.....		
18,000	18,000	.001005	.000080	.000145	.000050		
19,000	19,000	.001100	.000095	.....	.....		
20,000	20,000	.001200	.000100	.000205	.000060		
21,000	21,000	.001320	.000120	.....	.....		
22,000	22,000	.001450	.000130	.000315	.000110		
23,000	23,000	.001620	.000170	.....	.....		
24,000	24,000	.001795	.000175	.000540	.000225		
25,000	25,000	.002015	.000220	.000695	.000155		
26,010	26,010	.....	.....	.....	.....		Tensile strength.

Fractured 11" from neck. Appearance, granular.

1045.

Marks, 13 M R., T R.  
 B T.  
 Length, 10''<sup>5</sup>.  
 Diameter, 1''<sup>129</sup>.  
 Sectional area, 1 square inch.  
 Gauged length, 5''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0.				
2,000	2,000	.00004	.00004				
3,000	3,000	.00008	.00004				
4,000	4,000	.00012	.00004				
5,000	5,000	.00018	.00006	0.			
6,000	6,000	.00022	.00004				
7,000	7,000	.00026	.00004				
8,000	8,000	.00032	.00006				
9,000	9,000	.00038	.00006				
10,000	10,000	.00044	.00006	.00002	.00002		
11,000	11,000	.00050	.00006				
12,000	12,000	.00056	.00006				
13,000	13,000	.00068	.00002				
14,000	14,000	.00064	.00006				
15,000	15,000	.00070	.00006	.00001	.00002		
16,000	16,000	.00076	.00006				
17,000	17,000	.00082	.00006				
18,000	18,000	.00088	.00006				
19,000	19,000	.00094	.00006				
20,000	20,000	.00102	.00008	.00010	.00006		
21,000	21,000	.00108	.00006				
22,000	22,000	.00116	.00008				
23,000	23,000	.00122	.00006				
24,000	24,000	.00130	.00008				
25,000	25,000	.00140	.00010	.00020	.00010		
26,000	26,000	.00150	.00010				
27,000	27,000	.00158	.00008				
28,000	28,000	.00170	.00012				
29,000	29,000	.00180	.00010				
30,000	30,000	.00196	.00016	.00052	.00032		
31,000	31,000	.00214	.00018				
32,000	32,000	.00234	.00020				
33,000	33,000	.00250	.00016				
34,000	34,000	.00280	.00030				
35,000	35,000	.00310	.00030	.00140	.00088		
36,000	36,000	.00348	.00038				
37,000	37,000	.00380	.00032				
38,000	38,000	.00430	.00060				
39,000	39,000	.00472	.00042				
40,000	40,000	.00540	.00068	.00340	.00200		
41,000	41,000	.00580	.00050				
42,000	42,000	.00640	.00050				
43,000	43,000	.00688	.00048				
44,000	44,000	.00756	.00068				
45,000	45,000	.00832	.00076	.00800	.00280		
46,000	46,000	.00890	.00058				
47,000	47,000	.00942	.00052				
48,000	48,000	.01032	.00090				
49,000	49,000	.01120	.00088				
50,000	50,000	.01230	.00110	.00856	.00356		
59,720	59,720						Ultimate strength.

Failed by triple flexure.

No. 1046.

Marks, <sup>12M R<sub>10</sub> T R<sub>2</sub></sup>  
<sub>B R<sub>10</sub></sub>Length, 10''<sup>5</sup>/<sub>8</sub>.Diameter, 1''<sup>129</sup>/<sub>100</sub>.

Sectional area, 1 square inch.

Gauged length, 5''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.00004	.00004	.....	.....	
3,000	3,000	.00008	.00004	.....	.....	
4,000	4,000	.00012	.00004	.....	.....	
5,000	5,000	.00016	.00004	.....	.....	
6,000	6,000	.00020	.00004	.....	.....	
7,000	7,000	.00024	.00006	.....	.....	
8,000	8,000	.00030	.00004	.....	.....	
9,000	9,000	.00036	.00006	.....	.....	
10,000	10,000	.00042	.00006	.00002	.00002	
11,000	11,000	.00048	.00006	.....	.....	
12,000	12,000	.00052	.00004	.....	.....	
13,000	13,000	.00058	.00006	.....	.....	
14,000	14,000	.00064	.00006	.....	.....	
15,000	15,000	.00070	.00006	.00002	0.	
16,000	16,000	.00074	.00004	.....	.....	
17,000	17,000	.00080	.00006	.....	.....	
18,000	18,000	.00086	.00006	.....	.....	
19,000	19,000	.00092	.00006	.....	.....	
20,000	20,000	.00098	.00006	.00008	.00006	
21,000	21,000	.00104	.00006	.....	.....	
22,000	22,000	.00112	.00008	.....	.....	
23,000	23,000	.00120	.00008	.....	.....	
24,000	24,000	.00126	.00006	.....	.....	
25,000	25,000	.00132	.00006	.00020	.00012	
26,000	26,000	.00138	.00006	.....	.....	
27,000	27,000	.00144	.00010	.....	.....	
28,000	28,000	.00152	.00010	.....	.....	
29,000	29,000	.00162	.00010	.....	.....	
30,000	30,000	.00184	.00016	.00046	.00026	
31,000	31,000	.00206	.00022	.....	.....	
32,000	32,000	.00226	.00020	.....	.....	
33,000	33,000	.00250	.00024	.....	.....	
34,000	34,000	.00270	.00020	.....	.....	
35,000	35,000	.00302	.00032	.00140	.00064	
36,000	36,000	.00342	.00040	.....	.....	
37,000	37,000	.00386	.00044	.....	.....	
38,000	38,000	.00422	.00036	.....	.....	
39,000	39,000	.00470	.00048	.....	.....	
40,000	40,000	.00512	.00042	.00330	.00190	
41,000	41,000	.00560	.00048	.....	.....	
42,000	42,000	.00592	.00032	.....	.....	
43,000	43,000	.00640	.00048	.....	.....	
44,000	44,000	.00692	.00052	.....	.....	
45,000	45,000	.00766	.00074	.00546	.00216	
46,000	46,000	.00808	.00042	.....	.....	
47,000	47,000	.00840	.00032	.....	.....	
48,000	48,000	.00870	.00030	.....	.....	
49,000	49,000	.00896	.00026	.....	.....	
50,000	50,000	.00908	.00012	.00678	.00122	
58,640	58,640	.....	.....	.....	.....	

Ultimate strength.

Failed by triple flexure.

No. 1047.

Marks, <sup>12</sup> M R<sub>1</sub> T R<sub>1</sub>  
<sup>M T<sub>1</sub></sup>  
 Length, 10'' .5.  
 Diameter, 1'' .129.  
 Sectional area, 1 square inch.  
 Gauged length, 5''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0.				
2,000	2,000	.00004	.00004				
3,000	3,000	.00008	.00004				
4,000	4,000	.00012	.00004				
5,000	5,000	.00018	.00006	0.			
6,000	6,000	.00022	.00004				
7,000	7,000	.00028	.00006				
8,000	8,000	.00032	.00004				
9,000	9,000	.00038	.00006				
10,000	10,000	.00042	.00004	.00002	.00002		
11,000	11,000	.00048	.00006				
12,000	12,000	.00054	.00006				
13,000	13,000	.00060	0.0006				
14,000	14,000	.00066	.00006				
15,000	15,000	.00070	.00004	.00004	.00002		
16,000	16,000	.00076	.00006				
17,000	17,000	.00082	.00006				
18,000	18,000	.00088	.00006				
19,000	19,000	.00094	.00006				
20,000	20,000	.00100	.00006	.00010	.00006		
21,000	21,000	.00108	.00008				
22,000	22,000	.00114	.00006				
23,000	23,000	.00120	.00006				
24,000	24,000	.00128	.00008				
25,000	25,000	.00138	.00010	.00022	.00012		
26,000	26,000	.00150	.00012				
27,000	27,000	.00158	.00008				
28,000	28,000	.00168	.00010				
29,000	29,000	.00178	.00010				
30,000	30,000	.00192	.00014	.00052	.00030		
31,000	31,000	.00210	.00018				
32,000	32,000	.00230	.00020				
33,000	33,000	.00250	.00020				
34,000	34,000	.00280	.00030				
35,000	35,000	.00316	.00036	.00150	.00098		
36,000	36,000	.00364	.00048				
37,000	37,000	.00414	.00050				
38,000	38,000	.00456	.00042				
39,000	39,000	.00502	.00046				
40,000	40,000	.00574	.00072	.00376	.00226		
41,000	41,000	.00630	.00058				
42,000	42,000	.00660	.00030				
43,000	43,000	.00730	.00070				
44,000	44,000	.00812	.00082				
45,000	45,000	.00892	.00080	.00662	.00286		
46,000	46,000	.01022	.00110				
47,000	47,000	.01092	.00090				
50,000	50,000	.01590	.00498	.01300	.00638		
57,980	57,980						Ultimate strength.

Failed by triple flexure.

BODY No. 20.

No. 4681.

Marks, <sup>12 M R<sub>2</sub> T R<sub>2</sub></sup><sub>B T<sub>1</sub></sub>

Diameter, 1".129.

Sectional area, 1 square inch.

Length of stem, 23".

Gauged length, 20".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.000055	.000055			
3,000	3,000	.000105	.000050			
4,000	4,000	.000160	.000055			
5,000	5,000	.000210	.000050	0.		
6,000	6,000	.000265	.000055			
7,000	7,000	.000320	.000055			
8,000	8,000	.000380	.000060			
9,000	9,000	.000440	.000060			
10,000	10,000	.000500	.000060	.000015	.000015	
11,000	11,000	.000555	.000055			
12,000	12,000	.000625	.000070	.000045	.000030	
13,000	13,000	.000700	.000075			
14,000	14,000	.000785	.000065	.000055	.000010	
15,000	15,000	.000850	.000075			
16,000	16,000	.000940	.000090	.000100	.000045	
17,000	17,000	.001030	.000090			
18,000	18,000	.001135	.000105	.000165	.000065	
19,000	19,000	.001250	.000115			
20,000	20,000	.001375	.000125	.000275	.000110	
21,000	21,000	.001540	.000165			
22,000	22,000	.001710	.000170	.000475	.000200	
23,000	23,000	.001960	.000250			
24,000	24,000	.002225	.000265	.000800	.000325	
25,000	25,000	.002550	.000275	.001050	.000250	
26,220	26,220					

Fractured 9" from neck. Appearance, granular.

No. 4682.

Marks, <sup>13 M R, T B,</sup>  
<sup>M T,</sup>  
 Diameter, 1".129.  
 Sectional area, 1 square inch.  
 Length of stem, 23".  
 Gauged length, 20".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.000050	.000050	.....	.....	
3,000	3,000	.000100	.000050	.....	.....	
4,000	4,000	.000150	.000050	.....	.....	
5,000	5,000	.000200	.000050	0.	.....	
6,000	6,000	.000250	.000050	.....	.....	
7,000	7,000	.000300	.000050	.....	.....	
8,000	8,000	.000350	.000050	.....	.....	
9,000	9,000	.000400	.000050	.....	.....	
10,000	10,000	.000450	.000050	.000010	.000010	
11,000	11,000	.000500	.000050	.....	.....	
12,000	12,000	.000555	.000055	.000025	.000015	
13,000	13,000	.000615	.000060	.....	.....	
14,000	14,000	.000675	.000060	.000050	.000025	
15,000	15,000	.000740	.000065	.....	.....	
16,000	16,000	.000805	.000065	.000060	.000010	
17,000	17,000	.000885	.000080	.....	.....	
18,000	18,000	.000950	.000085	.000109	.000040	
19,000	19,000	.001050	.000100	.....	.....	
20,000	20,000	.001115	.000085	.000150	.000050	
21,000	21,000	.001235	.000120	.....	.....	
22,000	22,000	.001330	.000105	.000245	.000085	
23,000	23,000	.001455	.000125	.....	.....	
24,000	24,000	.001595	.000140	.000385	.000140	
25,000	25,000	.001800	.000205	.000505	.000120	
29,440	29,440	.....	.....	.....	.....	Tensile strength.

Fractured 10".9 from neck. Appearance, granular.

H. Ex. 43—16

No. 1048.

Marks, <sup>12 M R<sub>2</sub> T R<sub>2</sub></sup>  
<sub>B T<sub>2</sub></sub>  
 Length, 10' .5.  
 Diameter, 1" .129.  
 Sectional area, 1 square inch.  
 Gauged length, 5'.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.00004	.00004			
3,000	3,000	.00010	.00006			
4,000	4,000	.00014	.00004			
5,000	5,000	.00019	.00005	.00004	.00004	
6,000	6,000	.00024	.00005			
7,000	7,000	.00028	.00004			
8,000	8,000	.00032	.00006			
9,000	9,000	.00038	.00006			
10,000	10,000	.00044	.00006	.00016	.00012	
11,000	11,000	.00052	.00008			
12,000	12,000	.00056	.00004			
13,000	13,000	.00062	.00006			
14,000	14,000	.00068	.00006			
15,000	15,000	.00072	.00004	.00024	.00008	
16,000	16,000	.00080	.00008			
17,000	17,000	.00086	.00006			
18,000	18,000	.00092	.00006			
19,000	19,000	.00098	.00006			
20,000	20,000	.00106	.00008	.00030	.00006	
21,000	21,000	.00112	.00006			
22,000	22,000	.00120	.00008			
23,000	23,000	.00128	.00008			
24,000	24,000	.00134	.00006			
25,000	25,000	.00144	.00010	.00042	.00012	
26,000	26,000	.00152	.00008			
27,000	27,000	.00164	.00012			
28,000	28,000	.00172	.00008			
29,000	29,000	.00184	.00012			
30,000	30,000	.00200	.00016	.00068	.00026	
31,000	31,000	.00220	.00020			
32,000	32,000	.00236	.00016			
33,000	33,000	.00256	.00020			
34,000	34,000	.00280	.00024			
35,000	35,000	.00316	.00036	.00154	.00086	
36,000	36,000	.00348	.00032			
37,000	37,000	.00380	.00032			
38,000	38,000	.00412	.00032			
39,000	39,000	.00460	.00048			
40,000	40,000	.00510	.00050	.00324	.00170	
41,000	41,000	.00562	.00052			
42,000	42,000	.00596	.00034			
43,000	43,000	.00640	.00044			
44,000	44,000	.00680	.00040			
45,000	45,000	.00752	.00072	.00532	.00206	
46,000	46,000	.00798	.00046			
47,000	47,000	.00848	.00050			
48,000	48,000	.00892	.00044			
49,000	49,000	.00960	.00068			
50,000	50,000	.01040	.00080	.00788	.00256	
62,350	62,350					Ultimate strength.

Failed by triple flexure.



No. 1049.

Marks, <sup>12 M R<sub>2</sub> T R<sub>2</sub></sup>  
<sub>B R<sub>10</sub></sub>  
 Length, 10'<sup>11</sup>/<sub>5</sub>.  
 Diameter, 1'<sup>11</sup>/<sub>120</sub>.  
 Sectional area, 1 square inch.  
 Gauged length, 5''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load,	
1,000	1,000	0.	0.	0.	0.		
2,000	2,000	.00004	.00004				
3,000	3,000	.00010	.00008				
4,000	4,000	.00014	.00004				
5,000	5,000	.00018	.00001	0.			
6,000	6,000	.00020	.00002				
7,000	7,000	.00024	.00004				
8,000	8,000	.00028	.00004				
9,000	9,000	.00032	.00004				
10,000	10,000	.00036	.00004	.00010	.00010		
11,000	11,000	.00042	.00006				
12,000	12,000	.00048	.00006				
13,000	13,000	.00052	.00004				
14,000	14,000	.00056	.00004				
15,000	15,000	.00060	.00004	.00010	.00006		
16,000	16,000	.00068	.00008				
17,000	17,000	.00072	.00004				
18,000	18,000	.00078	.00006				
19,000	19,000	.00082	.00004				
20,000	20,000	.00088	.00006	.00020	.00004		
21,000	21,000	.00096	.00008				
22,000	22,000	.00106	.00010				
23,000	23,000	.00112	.00006				
24,000	24,000	.00118	.00006				
25,000	25,000	.00126	.00008	.00034	.00014		
26,000	26,000	.00140	.00014				
27,000	27,000	.00148	.00008				
28,000	28,000	.00158	.00010				
29,000	29,000	.00170	.00012				
30,000	30,000	.00186	.00016	.00066	.00032		
31,000	31,000	.00208	.00022				
32,000	32,000	.00222	.00014				
33,000	33,000	.00242	.00020				
34,000	34,000	.00272	.00030				
35,000	35,000	.00308	.00036	.00160	.00094		
36,000	36,000	.00350	.00042				
37,000	37,000	.00386	.00036				
38,000	38,000	.00416	.00030				
39,000	39,000	.00452	.00036				
40,000	40,000	.00520	.00068	.00348	.00188		
41,000	41,000	.00562	.00042				
42,000	42,000	.00592	.00030				
43,000	43,000	.00620	.00028				
44,000	44,000	.00660	.00040				
45,000	45,000	.00750	.00070	.00552	.00204		
46,000	46,000	.00798	.00018				
47,000	47,000	.00834	.00016				
48,000	48,000	.00868	.00034				
49,000	49,000	.00920	.00052				
50,000	50,000	.00970	.00050	.00750	.00198		
61,980	61,980						Ultimate strength.

Failed by triple flexure.

No. 1050.

Marks, <sup>12</sup>M R<sub>1</sub> T R<sub>1</sub>  
<sup>M</sup>T<sub>1</sub>  
 Length, 10''<sup>5</sup>.  
 Diameter, 1''<sup>129</sup>.  
 Sectional area, 1 square inch.  
 Gauged length, 5''.

Applied loads.		Compression per lbch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0.	0.	0.		
2,000	2,000	.00004	.00004	.....	.....		
3,000	3,000	.00008	.00008	.....	.....		
4,000	4,000	.00012	.00012	.....	.....		
5,000	5,000	.00016	.00016	.....	0.		
6,000	6,000	.00020	.00020	.....	.....		
7,000	7,000	.00026	.00026	.....	.....		
8,000	8,000	.00032	.00032	.....	.....		
9,000	9,000	.00036	.00036	.....	.....		
10,000	10,000	.00042	.00042	.....	0.		
11,000	11,000	.00046	.00046	.....	.....		
12,000	12,000	.00052	.00052	.....	.....		
13,000	13,000	.00056	.00056	.....	.....		
14,000	14,000	.00062	.00062	.....	.....		
15,000	15,000	.00068	.00068	.....	.00002		
16,000	16,000	.00074	.00074	.....	.....		
17,000	17,000	.00080	.00080	.....	.....		
18,000	18,000	.00086	.00086	.....	.....		
19,000	19,000	.00094	.00094	.....	.....		
20,000	20,000	.00100	.00100	.....	.00006		
21,000	21,000	.00104	.00104	.....	.00004		
22,000	22,000	.00110	.00110	.....	.....		
23,000	23,000	.00116	.00116	.....	.....		
24,000	24,000	.00122	.00122	.....	.....		
25,000	25,000	.00130	.00130	.....	.00012		
26,000	26,000	.00140	.00140	.....	.00006		
27,000	27,000	.00150	.00150	.....	.....		
28,000	28,000	.00160	.00160	.....	.....		
29,000	29,000	.00170	.00170	.....	.....		
30,000	30,000	.00184	.00184	.....	.00040		
31,000	31,000	.00202	.00202	.....	.00028		
32,000	32,000	.00220	.00220	.....	.....		
33,000	33,000	.00248	.00248	.....	.....		
34,000	34,000	.00284	.00284	.....	.....		
35,000	35,000	.00300	.00300	.....	.00130		
36,000	36,000	.00340	.00340	.....	.00090		
37,000	37,000	.00370	.00370	.....	.....		
38,000	38,000	.00400	.00400	.....	.....		
39,000	39,000	.00442	.00442	.....	.....		
40,000	40,000	.00496	.00496	.....	.00302		
42,000	42,000	.00618	.00618	.....	.00172		
43,000	43,000	.00688	.00688	.....	.....		
44,000	44,000	.00742	.00742	.....	.....		
45,000	45,000	.00796	.00796	.....	.00584		
46,000	46,000	.00880	.00880	.....	.00262		
47,000	47,000	.00966	.00966	.....	.....		
48,000	48,000	.01040	.01040	.....	.....		
49,000	49,000	.01124	.01124	.....	.....		
50,000	50,000	.01260	.01260	.....	.00970		
59,700	59,700	.....	.....	.....	.00406		
							Ultimate strength.

Failed by triple flexure.

Body No. 20 (second casting).

No. 4715.

Marks, 12 M B T B,  
B T

Diameter, 1".129.

Sectional area, 1 square inch.

Length of stem, 23".

Gauged length, 20".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.000045	.000045			
3,000	3,000	.000095	.000050			
4,000	4,000	.000145	.000050			
5,000	5,000	.000195	.000050	0.		
6,000	6,000	.000250	.000055			
7,000	7,000	.000300	.000050			
8,000	8,000	.000350	.000050			
9,000	9,000	.000400	.000050			
10,000	10,000	.000455	.000055	.000025	.000025	
11,000	11,000	.000525	.000070			
12,000	12,000	.000590	.000085	.000045	.000020	
13,000	13,000	.000650	.000090			
14,000	14,000	.000710	.000090	.000090	.000015	
15,000	15,000	.000785	.000075			
16,000	16,000	.000855	.000070	.000100	.000040	
17,000	17,000	.000950	.000095			
18,000	18,000	.001045	.000095	.000150	.000050	
19,000	19,000	.001150	.000105			
20,000	20,000	.001245	.000095	.000245	.000095	
21,000	21,000	.001380	.000115			
22,000	22,000	.001515	.000135	.000390	.000145	
23,000	23,000	.001705	.000190			
24,000	24,000	.001920	.000215	.000640	.000250	
25,000	25,000	.002165	.000245	.000830	.000190	
25,710	25,710					Tensile strength.

Fractured 4".8 from neck. Appearance, granular.

No. 4716.

Marks, <sup>12 M R, T R,</sup>  
<sup>M T,</sup>  
 Diameter, 1".129.  
 Sectional area, 1 square inch.  
 Length of stem, 23".  
 Gauged length, 20".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.000045	.000045	.....	.....	
3,000	3,000	.000090	.000045	.....	.....	
4,000	4,000	.000140	.000050	.....	.....	
5,000	5,000	.000190	.000050	0.	.....	
6,000	6,000	.000235	.000045	.....	.....	
7,000	7,000	.000285	.000050	.....	.....	
8,000	8,000	.000330	.000045	.....	.....	
9,000	9,000	.000385	.000055	.....	.....	
10,000	10,000	.000430	.000045	.000005	.000005	
11,000	11,000	.000490	.000060	.....	.....	
12,000	12,000	.000545	.000055	.000020	.000015	
13,000	13,000	.000590	.000045	.....	.....	
14,000	14,000	.000650	.000060	.000045	.000025	
15,000	15,000	.000710	.000060	.....	.....	
16,000	16,000	.000775	.000065	.000060	.000015	
17,000	17,000	.000835	.000060	.....	.....	
18,000	18,000	.000900	.000065	.000095	.000035	
19,000	19,000	.000980	.000080	.....	.....	
20,000	20,000	.001055	.000075	.000130	.000035	
21,000	21,000	.001150	.000095	.....	.....	
22,000	22,000	.001230	.000080	.000200	.000070	
23,000	23,000	.001340	.000110	.....	.....	
24,000	24,000	.001450	.000110	.000300	.000100	
25,000	25,000	.001600	.000150	.000300	.000090	
28,320	28,320	.....	.....	.....	.....	Tensile strength.

Fractured 11".5 from neck. Appearance, granular.

No. 1073.

Marks, <sup>12 M R. T R.</sup>  
<sup>B T. 12</sup>  
 Length, 10' 5".  
 Diameter, 1' 129.  
 Sectional area, 1 square inch.  
 Gauged length, 5'.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
0.	0.	0.	0.	0.	0.	
1,000	1,000	.00006	.00006			
2,000	2,000	.00010	.00010			
3,000	3,000	.00016	.00016			
4,000	4,000	.00020	.00020	.00002	.00002	
5,000	5,000	.00028	.00028			
6,000	6,000	.00032	.00032			
7,000	7,000	.00038	.00038			
8,000	8,000	.00042	.00042			
9,000	9,000	.00048	.00048	.00006	.00001	
10,000	10,000	.00054	.00054			
11,000	11,000	.00060	.00060			
12,000	12,000	.00066	.00066			
13,000	13,000	.00070	.00070			
14,000	14,000	.00076	.00076	.00010	.00004	
15,000	15,000	.00080	.00080			
16,000	16,000	.00086	.00086			
17,000	17,000	.00092	.00092			
18,000	18,000	.00098	.00098			
19,000	19,000	.00106	.00106	.00016	.00006	
20,000	20,000	.00112	.00112			
21,000	21,000	.00118	.00118			
22,000	22,000	.00128	.00128			
23,000	23,000	.00136	.00136			
24,000	24,000	.00142	.00142	.00026	.00010	
25,000	25,000	.00152	.00152			
26,000	26,000	.00160	.00160			
27,000	27,000	.00170	.00170			
28,000	28,000	.00182	.00182			
29,000	29,000	.00196	.00196	.00052	.00026	
30,000	30,000	.00210	.00210			
31,000	31,000	.00224	.00224			
32,000	32,000	.00248	.00248			
33,000	33,000	.00276	.00276			
34,000	34,000	.00302	.00302	.00136	.00084	
35,000	35,000	.00340	.00340			
36,000	36,000	.00380	.00380			
37,000	37,000	.00428	.00428			
38,000	38,000	.00480	.00480	.00052		
39,000	39,000	.00534	.00534	.00336	.00200	
40,000	40,000	.00572	.00572			
41,000	41,000	.00630	.00630			
42,000	42,000	.00698	.00698			
43,000	43,000	.00752	.00752			
44,000	44,000	.00820	.00820	.00600	.00264	
45,000	45,000	.00870	.00870			
46,000	46,000	.00960	.00960			
47,000	47,000	.01046	.01046			
48,000	48,000	.01130	.01130			
49,000	49,000	.01272	.01272	.01000	.00400	
50,000	50,000					
60,670	60,670					Ultimate strength.

Failed by triple flexure.

No. 4716.

Marks, <sup>12 M R, T R,</sup>  
<sub>M T</sub>  
 Diameter, 1".129.  
 Sectional area, 1 square inch.  
 Length of stem, 23".  
 Gauged length, 20".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.000045	.000045	.....	.....	
3,000	3,000	.000090	.000045	.....	.....	
4,000	4,000	.000140	.000050	.....	.....	
5,000	5,000	.000190	.000050	0.	.....	
6,000	6,000	.000235	.000045	.....	.....	
7,000	7,000	.000285	.000050	.....	.....	
8,000	8,000	.000330	.000045	.....	.....	
9,000	9,000	.000385	.000055	.....	.....	
10,000	10,000	.000430	.000045	.000005	.000005	
11,000	11,000	.000490	.000060	.....	.....	
12,000	12,000	.000545	.000055	.000020	.000015	
13,000	13,000	.000590	.000045	.....	.....	
14,000	14,000	.000650	.000060	.000045	.000025	
15,000	15,000	.000710	.000060	.....	.....	
16,000	16,000	.000775	.000065	.000060	.000015	
17,000	17,000	.000835	.000060	.....	.....	
18,000	18,000	.000900	.000065	.000065	.000035	
19,000	19,000	.000980	.000080	.....	.....	
20,000	20,000	.001055	.000075	.000130	.000035	
21,000	21,000	.001150	.000065	.....	.....	
22,000	22,000	.001230	.000080	.000200	.000070	
23,000	23,000	.001340	.000110	.....	.....	
24,000	24,000	.001450	.000110	.000300	.000100	
25,000	25,000	.001600	.000150	.000300	.000090	
28,320	28,320	.....	.....	.....	.....	Tensile strength.

Fractured 11".5 from neck. Appearance, granular.

No. 1073.

Marks, <sup>12 M R, T R,</sup>  
<sup>B T,</sup>  
 Length, 10' 5".  
 Diameter, 1' .129.  
 Sectional area, 1 square inch.  
 Gauged length, 5'.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0.	0.	0.		
2,000	2,000	.00006	.00006	.....	.....		
3,000	3,000	.00010	.00010	.....	.....		
4,000	4,000	.00018	.00018	.....	.....		
5,000	5,000	.00020	.00020	.00002	.00002		
6,000	6,000	.00028	.00028	.....	.....		
7,000	7,000	.00032	.00032	.....	.....		
8,000	8,000	.00038	.00038	.....	.....		
9,000	9,000	.00042	.00042	.....	.....		
10,000	10,000	.00048	.00048	.00006	.00001		
11,000	11,000	.00054	.00054	.....	.....		
12,000	12,000	.00060	.00060	.....	.....		
13,000	13,000	.00066	.00066	.....	.....		
14,000	14,000	.00070	.00070	.....	.....		
15,000	15,000	.00078	.00078	.00010	.00004		
16,000	16,000	.00090	.00090	.....	.....		
17,000	17,000	.00086	.00086	.....	.....		
18,000	18,000	.00092	.00092	.....	.....		
19,000	19,000	.00098	.00098	.....	.....		
20,000	20,000	.00106	.00106	.00010	.00006		
21,000	21,000	.00112	.00112	.00006	.....		
22,000	22,000	.00118	.00118	.....	.....		
23,000	23,000	.00128	.00128	.00010	.....		
24,000	24,000	.00136	.00136	.....	.....		
25,000	25,000	.00142	.00142	.00026	.00010		
26,000	26,000	.00152	.00152	.....	.....		
27,000	27,000	.00160	.00160	.00008	.....		
28,000	28,000	.00170	.00170	.....	.....		
29,000	29,000	.00182	.00182	.....	.....		
30,000	30,000	.00196	.00196	.00052	.00026		
31,000	31,000	.00210	.00210	.00014	.....		
32,000	32,000	.00224	.00224	.....	.....		
33,000	33,000	.00248	.00248	.....	.....		
34,000	34,000	.00276	.00276	.....	.....		
35,000	35,000	.00302	.00302	.00136	.00084		
36,000	36,000	.00340	.00340	.....	.....		
37,000	37,000	.00380	.00380	.....	.....		
38,000	38,000	.00428	.00428	.....	.....		
39,000	39,000	.00480	.00480	.00052	.....		
40,000	40,000	.00534	.00534	.00336	.00200		
41,000	41,000	.00572	.00572	.00038	.....		
42,000	42,000	.00630	.00630	.....	.....		
43,000	43,000	.00698	.00698	.....	.....		
44,000	44,000	.00752	.00752	.....	.....		
45,000	45,000	.00820	.00820	.00600	.00264		
46,000	46,000	.00870	.00870	.....	.....		
47,000	47,000	.00960	.00960	.....	.....		
48,000	48,000	.01046	.01046	.....	.....		
49,000	49,000	.01130	.01130	.....	.....		
50,000	50,000	.01272	.01272	.01000	.00400		
60,670	60,670	.....	.....	.....	.....		Ultimate strength.

Failed by triple flexure.

No. 1074.

Marks, <sup>12 M R<sub>2</sub> T R<sub>2</sub></sup>  
<sub>B R<sub>2</sub></sub>  
 Length, 10'' .5.  
 Diameter, 1'' .129.  
 Sectional area, 1 square inch.  
 Gaged length, 5''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0.	0.	0.		
2,000	2,000	.00004	.00004	.....	.....		
3,000	3,000	.00010	.00006	.....	.....		
4,000	4,000	.00014	.00004	.....	.....		
5,000	5,000	.00018	.00004	.00002	.00002		
6,000	6,000	.00022	.00004	.....	.....		
7,000	7,000	.00028	.00000	.....	.....		
8,000	8,000	.00032	.00004	.....	.....		
9,000	9,000	.00038	.00006	.....	.....		
10,000	10,000	.00042	.00004	.00006	.00004		
11,000	11,000	.00050	.00008	.....	.....		
12,000	12,000	.00054	.00004	.....	.....		
13,000	13,000	.00060	.00000	.....	.....		
14,000	14,000	.00064	.00004	.....	.....		
15,000	15,000	.00070	.00006	.00010	.00004		
16,000	16,000	.00076	.00006	.....	.....		
17,000	17,000	.00082	.00006	.....	.....		
18,000	18,000	.00088	.00006	.....	.....		
19,000	19,000	.00092	.00004	.....	.....		
20,000	20,000	.00100	.00008	.00014	.00004		
21,000	21,000	.00106	.00006	.....	.....		
22,000	22,000	.00112	.00006	.....	.....		
23,000	23,000	.00118	.00000	.....	.....		
24,000	24,000	.00126	.00008	.....	.....		
25,000	25,000	.00134	.00008	.00024	.00010		
26,000	26,000	.00142	.00008	.....	.....		
27,000	27,000	.00152	.00010	.....	.....		
28,000	28,000	.00160	.00038	.....	.....		
29,000	29,000	.00172	.00012	.....	.....		
30,000	30,000	.00188	.00016	.00052	.00028		
31,000	31,000	.00204	.00016	.....	.....		
32,000	32,000	.00220	.00010	.....	.....		
33,000	33,000	.00244	.00024	.....	.....		
34,000	34,000	.00272	.00028	.....	.....		
35,000	35,000	.00310	.00038	.00148	.00096		
36,000	36,000	.00344	.00034	.....	.....		
37,000	37,000	.00380	.00030	.....	.....		
38,000	38,000	.00422	.00042	.....	.....		
39,000	39,000	.00474	.00052	.....	.....		
40,000	40,000	.00522	.00048	.00350	.00202		
41,000	41,000	.00560	.00038	.....	.....		
42,000	42,000	.00622	.00062	.....	.....		
43,000	43,000	.00680	.00058	.....	.....		
44,000	44,000	.00732	.00052	.....	.....		
45,000	45,000	.00802	.00070	.00580	.00230		
46,000	46,000	.00878	.00076	.....	.....		
47,000	47,000	.00924	.00046	.....	.....		
48,000	48,000	.00992	.00068	.....	.....		
49,000	49,000	.01076	.00084	.....	.....		
50,000	50,000	.01168	.00092	.00906	.00326		
60,200	60,200	.....	.....	.....	.....		Ultimate strength.

Failed by triple flexure.



No. 1075.

Marks, <sup>12</sup>M R, <sup>T R</sup>  
<sup>M 13</sup>  
 Length, 10' 5".  
 Diameter, 1" .129.  
 Sectional area, 1 square inch.  
 Gauged length, 5".

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.		
1,000	1,000	0.	0.	0.	0.	Initial load.	
2,000	2,000	.00004	.00004				
3,000	3,000	.00010	.00006				
4,000	4,000	.00014	.00004				
5,000	5,000	.00018	.00004	0.			
6,000	6,000	.00022	.00004				
7,000	7,000	.00028	.00006				
8,000	8,000	.00032	.00004				
9,000	9,000	.00038	.00006				
10,000	10,000	.00042	.00004	0.			
11,000	11,000	.00046	.00004				
12,000	12,000	.00052	.00006				
13,000	13,000	.00058	.00006				
14,000	14,000	.00062	.00004				
15,000	15,000	.00068	.00006	.00002	.00002		
16,000	16,000	.00072	.00004				
17,000	17,000	.00078	.00006				
18,000	18,000	.00084	.00006				
19,000	19,000	.00088	.00004				
20,000	20,000	.00094	.00006	.00006	.00004		
21,000	21,000	.00100	.00006				
22,000	22,000	.00106	.00006				
23,000	23,000	.00112	.00006				
24,000	24,000	.00118	.00006				
25,000	25,000	.00124	.00004	.00012	.00006		
26,000	26,000	.00132	.00006				
27,000	27,000	.00138	.00006				
28,000	28,000	.00148	.00010				
29,000	29,000	.00158	.00010				
30,000	30,000	.00168	.00010	.00030	.00018		
31,000	31,000	.00180	.00012				
32,000	32,000	.00190	.00010				
33,000	33,000	.00202	.00012				
34,000	34,000	.00224	.00022				
35,000	35,000	.00250	.00026	.00086	.00056		
36,000	36,000	.00272	.00022				
37,000	37,000	.00296	.00024				
38,000	38,000	.00322	.00026				
39,000	39,000	.00360	.00038				
40,000	40,000	.00412	.00052	.00224	.00138		
41,000	41,000	.00452	.00040				
42,000	42,000	.00490	.00038				
43,000	43,000	.00522	.00032				
44,000	44,000	.00590	.00068				
45,000	45,000	.00636	.00046	.00422	.00198		
46,000	46,000	.00682	.00046				
47,000	47,000	.00728	.00046				
48,000	48,000	.00772	.00044				
49,000	49,000	.00830	.00058				
50,000	50,000	.00892	.00062	.00652	.00230		
60,050	60,050						Ultimate strength.

Failed by triple flexure.

BODY No. 21.

No. 4683.

Marks, <sup>12 M R., T R.,</sup>  
<sub>B T.</sub>

Diameter, 1".129.

Sectional area, 1 square inch.

Length of stem, 23".

Gauged length, 20".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.000055	.000055	.....	.....	
3,000	3,000	.000105	.000050	.....	.....	
4,000	4,000	.000155	.000050	.....	.....	
5,000	5,000	.000210	.000055	.000005	.000005	
6,000	6,000	.000270	.000060	.....	.....	
7,000	7,000	.000330	.000060	.....	.....	
8,000	8,000	.000380	.000050	.....	.....	
9,000	9,000	.000435	.000055	.....	.....	
10,000	10,000	.000490	.000055	.003030	.000025	
11,000	11,000	.000545	.000055	.....	.....	
12,000	12,000	.000615	.000070	.000040	.000010	
13,000	13,000	.000680	.000065	.....	.....	
14,000	14,000	.000740	.000060	.000075	.000035	
15,000	15,000	.000835	.000085	.....	.....	
16,000	16,000	.000910	.000075	.000105	.000030	
17,000	17,000	.001000	.000090	.....	.....	
18,000	18,000	.001090	.000090	.000180	.000075	
19,000	19,000	.001200	.000110	.....	.....	
20,000	20,000	.001335	.000135	.000285	.000105	
21,000	21,000	.001470	.000125	.....	.....	
22,000	22,000	.001635	.000165	.000435	.000150	
23,000	23,000	.001880	.000245	.....	.....	
24,000	24,000	.002110	.000230	.000770	.000335	
25,000	25,000	.002435	.000325	.001020	.000250	
28,640	28,640	.....	.....	.....	.....	

Fractured 8".6 from neck. Appearance, granular.

No. 4684.

Marks, 12 M R, T R,  
M 7,  
Diameter, 1".129.  
Sectional area, 1 square inch.  
Length of stem, 23".  
Gauged length, 20".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.000055	.000055			
3,000	3,000	.000110	.000055			
4,000	4,000	.000160	.000050			
5,000	5,000	.000220	.000060	.000010	.000010	
6,000	6,000	.000275	.000055			
7,000	7,000	.000330	.000055			
8,000	8,000	.000390	.000060			
9,000	9,000	.000450	.000060			
10,000	10,000	.000505	.000055	.000040	.000030	
11,000	11,000	.000560	.000055			
12,000	12,000	.000625	.000065	.000050	.000010	
13,000	13,000	.000690	.000065			
14,000	14,000	.000755	.000065	.000075	.000025	
15,000	15,000	.000840	.000085			
16,000	16,000	.000910	.000070	.000105	.000030	
17,000	17,000	.000985	.000085			
18,000	18,000	.001100	.000105	.000105	.000000	
19,000	19,000	.001200	.000100			
20,000	20,000	.001300	.000100	.000250	.000085	
21,000	21,000	.001450	.000150			
22,000	22,000	.001600	.000150	.000410	.000160	
23,000	23,000	.001800	.000200			
24,000	24,000	.002010	.000210	.000670	.000200	
25,000	25,000	.002340	.000330	.000900	.000230	
29,140	29,140					Tensile strength.

Fractured 2".6 from neck. Appearance, granular.

No. 1051.

Marks,  $12 M_{B T R}$   
 $B T_1$   
 Length, 10'' $\frac{5}{8}$ .  
 Diameter, 1'' $\frac{129}{1000}$ .  
 Sectional area, 1 square inch.  
 Gauged length, 5''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0.	0.	0.		
2,000	2,000	.00004	.00004	.....	.....		
3,000	3,000	.00010	.00006	.....	.....		
4,000	4,000	.00014	.00004	.....	.....		
5,000	5,000	.00020	.00006	.00002	.00002		
6,000	6,000	.00028	.00008	.....	.....		
7,000	7,000	.00032	.00004	.....	.....		
8,000	8,000	.00036	.00004	.....	.....		
9,000	9,000	.00042	.00006	.....	.....		
10,000	10,000	.00046	.00004	.00004	.00002		
11,000	11,000	.00052	.00006	.....	.....		
12,000	12,000	.00058	.00006	.....	.....		
13,000	13,000	.00062	.00004	.....	.....		
14,000	14,000	.00070	.00008	.....	.....		
15,000	15,000	.00074	.00004	.00008	.00004		
16,000	16,000	.00082	.00008	.....	.....		
17,000	17,000	.00088	.00006	.....	.....		
18,000	18,000	.00092	.00004	.....	.....		
19,000	19,000	.00098	.00006	.....	.....		
20,000	20,000	.00106	.00008	.00014	.00006		
21,000	21,000	.00112	.00006	.....	.....		
22,000	22,000	.00120	.00008	.....	.....		
23,000	23,000	.00128	.00008	.....	.....		
24,000	24,000	.00136	.00008	.....	.....		
25,000	25,000	.00144	.00008	.00028	.00014		
26,000	26,000	.00152	.00008	.....	.....		
27,000	27,000	.00162	.00010	.....	.....		
28,000	28,000	.00170	.00008	.....	.....		
29,000	29,000	.00184	.00014	.....	.....		
30,000	30,000	.00198	.00014	.00058	.00030		
31,000	31,000	.00218	.00020	.....	.....		
32,000	32,000	.00232	.00014	.....	.....		
33,000	33,000	.00260	.00028	.....	.....		
34,000	34,000	.00290	.00030	.....	.....		
35,000	35,000	.00330	.00040	.00162	.00108		
36,000	36,000	.00366	.00036	.....	.....		
37,000	37,000	.00392	.00026	.....	.....		
38,000	38,000	.00440	.00048	.....	.....		
39,000	39,000	.00486	.00046	.....	.....		
40,000	40,000	.00530	.00044	.00334	.00172		
41,000	41,000	.00598	.00068	.....	.....		
42,000	42,000	.00644	.00046	.....	.....		
43,000	43,000	.00700	.00056	.....	.....		
44,000	44,000	.00762	.00062	.....	.....		
45,000	45,000	.00820	.00058	.00594	.00260		
46,000	46,000	.00880	.00060	.....	.....		
47,000	47,000	.00912	.00032	.....	.....		
48,000	48,000	.00962	.00050	.....	.....		
49,000	49,000	.01016	.00054	.....	.....		
50,000	50,000	.01052	.00036	.00806	.00212		
60,200	60,200	.....	.....	.....	.....		Ultimate strength.

Failed by triple flexure.

No. 1052.

Marks, <sup>12 M R<sub>1</sub> T R<sub>2</sub></sup>  
<sub>B R<sub>2</sub></sub>  
 Length, 10''<sup>5</sup>.  
 Diameter, 1''<sup>129</sup>.  
 Sectional area, 1 square inch.  
 Gauged length, 5''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.00004	.00004	.....	.....	
3,000	3,000	.00008	.00004	.....	.....	
4,000	4,000	.00012	.00004	.....	.....	
5,000	5,000	.00018	.00006	0.	.....	
6,000	6,000	.00022	.00004	.....	.....	
7,000	7,000	.00028	.00006	.....	.....	
8,000	8,000	.00032	.00004	.....	.....	
9,000	9,000	.00036	.00004	.....	.....	
10,000	10,000	.00042	.00008	.00004	.00004	
11,000	11,000	.00048	.00006	.....	.....	
12,000	12,000	.00054	.00006	.....	.....	
13,000	13,000	.00060	.00006	.....	.....	
14,000	14,000	.00066	.00006	.....	.....	
15,000	15,000	.00070	.00014	.00008	.00004	
16,000	16,000	.00076	.00006	.....	.....	
17,000	17,000	.00082	.00006	.....	.....	
18,000	18,000	.00088	.00006	.....	.....	
19,000	19,000	.00094	.00006	.....	.....	
20,000	20,000	.00102	.00008	.00012	.00004	
21,000	21,000	.00108	.00006	.....	.....	
22,000	22,000	.00114	.00006	.....	.....	
23,000	23,000	.00120	.00006	.....	.....	
24,000	24,000	.00130	.00010	.....	.....	
25,000	25,000	.00140	.00010	.00026	.00014	
26,000	26,000	.00148	.00008	.....	.....	
27,000	27,000	.00158	.00010	.....	.....	
28,000	28,000	.00168	.00010	.....	.....	
29,000	29,000	.00180	.00012	.....	.....	
30,000	30,000	.00198	.00018	.00060	.00034	
31,000	31,000	.00218	.00020	.....	.....	
32,000	32,000	.00240	.00022	.....	.....	
33,000	33,000	.00260	.00020	.....	.....	
34,000	34,000	.00288	.00028	.....	.....	
35,000	35,000	.00320	.00032	.00154	.00094	
36,000	36,000	.00368	.00048	.....	.....	
37,000	37,000	.00410	.00042	.....	.....	
38,000	38,000	.00452	.00042	.....	.....	
39,000	39,000	.00500	.00048	.....	.....	
40,000	40,000	.00554	.00054	.00360	.00206	
41,000	41,000	.00602	.00048	.....	.....	
42,000	42,000	.00638	.00036	.....	.....	
43,000	43,000	.00700	.00062	.....	.....	
44,000	44,000	.00750	.00050	.....	.....	
45,000	45,000	.00810	.00060	.00590	.00230	
46,000	46,000	.00858	.00048	.....	.....	
47,000	47,000	.00900	.00042	.....	.....	
48,000	48,000	.00950	.00050	.....	.....	
49,000	49,000	.00986	.00036	.....	.....	
50,000	50,000	.01016	.00030	.00780	.00190	
50,580	50,580	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

No. 1053.

Marks, <sup>12 M R<sub>11</sub> T B<sub>1</sub></sup>  
<sup>M T<sub>1</sub></sup>  
 Length, 10<sup>1</sup>/<sub>2</sub>  
 Diameter, 1" .129.  
 Sectional area, 1 square inch.  
 Gauged length, 5".

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.		
1,000	1,000	0.	0.			Initial load.	
2,000	2,000	.00036	.00006				
3,000	3,000	.00012	.00006				
4,000	4,000	.00016	.00004				
5,000	5,000	.00022	.00006	.00004	.00001		
6,000	6,000	.00028	.00006				
7,000	7,000	.00032	.00004				
8,000	8,000	.00038	.00006				
9,000	9,000	.00044	.00006				
10,000	10,000	.00050	.00006	.00008	.00004		
11,000	11,000	.00058	.00008				
12,000	12,000	.00062	.00004				
13,000	13,000	.00068	.00006				
14,000	14,000	.00072	.00004				
15,000	15,000	.00078	.00006	.00014	.00006		
16,000	16,000	.00086	.00008				
17,000	17,000	.00092	.00006				
18,000	18,000	.00100	.00008				
19,000	19,000	.00106	.00006				
20,000	20,000	.00110	.00006	.00020	.00006		
21,000	21,000	.00120	.00010				
22,000	22,000	.00126	.00006				
23,000	23,000	.00132	.00006				
24,000	24,000	.00140	.00008				
25,000	25,000	.00150	.00010	.00034	.00014		
26,000	26,000	.00162	.00012				
27,000	27,000	.00170	.00008				
28,000	28,000	.00182	.00012				
29,000	29,000	.00194	.00012				
30,000	30,000	.00210	.00016	.00008	.00034		
31,000	31,000	.00230	.00020				
32,000	32,000	.00252	.00022				
33,000	33,000	.00278	.00026				
34,000	34,000	.00306	.00028				
35,000	35,000	.00340	.00034	.00172	.00104		
36,000	36,000	.00380	.00040				
37,000	37,000	.00418	.00038				
38,000	38,000	.00468	.00050				
39,000	39,000	.00520	.00052				
40,000	40,000	.00562	.00042	.00366	.00194		
41,000	41,000	.00610	.00048				
42,000	42,000	.00660	.00050				
43,000	43,000	.00702	.00042				
44,000	44,000	.00750	.00048				
45,000	45,000	.00802	.00052	.00582	.00216		
46,000	46,000	.00840	.00058				
47,000	47,000	.00872	.00032				
48,000	48,000	.00900	.00028				
49,000	49,000	.00922	.00022				
50,000	50,000	.00946	.00024	.00720	.00138		
57,490	57,490						Ultimate strength.

Failed by triple flexure.

BODY No. 21.

EXTRA MUZZLE DISK.

No. 4699.

Marks, <sup>12 M R<sub>1</sub> T R,</sup>  
<sub>M T,</sub>  
 Diameter, 1".129.  
 Sectional area, 1 square inch.  
 Length of stem, 23".  
 Gauged length, 20".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.000055	.000055			
3,000	3,000	.000105	.000050			
4,000	4,000	.000155	.000050			
5,000	5,000	.000210	.000055	.000005	.000005	
6,000	6,000	.000260	.000050			
7,000	7,000	.000320	.000060			
8,000	8,000	.000385	.000065			
9,000	9,000	.000445	.000060			
10,000	10,000	.000500	.000055	.000015	.000040	
11,000	11,000	.000560	.000060			
12,000	12,000	.000625	.000065	.000050	.000005	
13,000	13,000	.0007.0	.000075			
14,000	14,000	.000765	.000085	.000090	.000040	
15,000	15,000	.000850	.000085			
16,000	16,000	.000925	.000075	.000120	.000030	
17,000	17,000	.001015	.000090			
18,000	18,000	.001105	.000090	.000195	.000075	
19,000	19,000	.001225	.000120			
20,000	20,000	.001350	.000125	.000285	.000090	
21,000	21,000	.001510	.000160			
22,000	22,000	.001660	.000150	.000460	.000175	
23,000	23,000	.001855	.000.95			
24,000	24,000	.002090	.000235	.000750	.000290	
25,000	25,000	.002425	.000335	.001000	.000250	
27,870	27,870					Tensile strength.

Fractured 9".1 from neck. Appearance, granular.

Marks, <sup>12 M R T R</sup><sub>M T</sub>  
 Length, 10''<sup>5</sup>.  
 Diameter, 1''<sup>.129</sup>.  
 Sectional area, 1 square inch.  
 Gauged length, 5''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0.	0.	0.		
2,000	2,000	.00004	.00004				
3,000	3,000	.00008	.00004				
4,000	4,000	.00014	.00008				
5,000	5,000	.00020	.00006	0.			
6,000	6,000	.00024	.00004				
7,000	7,000	.00030	.00006				
8,000	8,000	.00036	.00006				
9,000	9,000	.00042	.00006				
10,000	10,000	.00050	.00008	0.			
11,000	11,000	.00054	.00004				
12,000	12,000	.00060	.00006				
13,000	13,000	.00066	.00006				
14,000	14,000	.00072	.00006				
15,000	15,000	.00078	.00006	.00002	.00002		
16,000	16,000	.00082	.00004				
17,000	17,000	.00090	.00008				
18,000	18,000	.00096	.00006				
19,000	19,000	.00102	.00006				
20,000	20,000	.00108	.00006	.00010	.00008		
21,000	21,000	.00114	.00006				
22,000	22,000	.00122	.00008				
23,000	23,000	.00130	.00008				
24,000	24,000	.00138	.00008				
25,000	25,000	.00148	.00010	.00022	.00012		
26,000	26,000	.00158	.00010				
27,000	27,000	.00168	.00010				
28,000	28,000	.00178	.00010				
29,000	29,000	.00192	.00014				
30,000	30,000	.00210	.00018	.00060	.00038		
31,000	31,000	.00230	.00020				
32,000	32,000	.00256	.00026				
33,000	33,000	.00278	.00022				
34,000	34,000	.00310	.00032				
35,000	35,000	.00350	.00040	.00174	.00114		
36,000	36,000	.00394	.00044				
37,000	37,000	.00438	.00044				
38,000	38,000	.00490	.00052				
39,000	39,000	.00548	.00058				
40,000	40,000	.00594	.00046	.00394	.00220		
41,000	41,000	.00646	.00052				
42,000	42,000	.00710	.00064				
43,000	43,000	.00790	.00050				
44,000	44,000	.00826	.00066				
45,000	45,000	.00880	.00054	.00646	.00252		
46,000	46,000	.00942	.00062				
47,000	47,000	.01004	.00062				
48,000	48,000	.01070	.00066				
49,000	49,000	.01174	.00104				
50,000	50,000	.01228	.00054	.00968	.00322		
57,580	57,580						Ultimate strength.

Failed by triple flexure.



BODY No. 21 (second casting).

No. 4749.

Marks, 12 M R, T R,  
B T,

Diameter, 1" .129.

Sectional area, 1 square inch.

Length of stem, 23".

Gauged length, 20".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.000045	.000045	.....	.....	
3,000	3,000	.000095	.000050	.....	.....	
4,000	4,000	.000145	.000050	.....	.....	
5,000	5,000	.000195	.000050	0.	.....	
6,000	6,000	.000250	.000055	.....	.....	
7,000	7,000	.000300	.000050	.....	.....	
8,000	8,000	.000355	.000055	.....	.....	
9,000	9,000	.000425	.000070	.....	.....	
10,000	10,000	.000490	.000085	.000025	.000025	
11,000	11,000	.000550	.000080	.....	.....	
12,000	12,000	.000610	.000080	.000050	.000025	
13,000	13,000	.000690	.000080	.....	.....	
14,000	14,000	.000760	.000070	.000085	.000035	
15,000	15,000	.000850	.000090	.....	.....	
16,000	16,000	.000940	.000090	.000120	.000035	
17,000	17,000	.001040	.000100	.....	.....	
18,000	18,000	.001125	.000085	.000190	.000070	
19,000	19,000	.001250	.000125	.....	.....	
20,000	20,000	.001375	.000125	.000300	.000110	
21,000	21,000	.001550	.000175	.....	.....	
22,000	22,000	.001700	.000150	.000485	.000185	
23,000	23,000	.001945	.000245	.....	.....	
24,000	24,000	.002200	.000255	.000815	.000330	
25,000	25,000	.002800	.000400	.001110	.000295	
25,320	25,320	.....	.....	.....	.....	Tensile strength.

Fractured 5".8 from neck. Appearance, granular.

H. Ex. 43—17

No. 4750.

Marks, <sup>12</sup>M R<sub>1</sub>, T R<sub>1</sub>  
<sup>M T<sub>11</sub></sup>  
 Diameter, 1".129.  
 Sectional area, 1 square inch.  
 Length of stem, 23".  
 Gauged length, 20".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0.	0.	0.		
2,000	2,000	.000050	.000050	.....	.....		
3,000	3,000	.000095	.000045	.....	.....		
4,000	4,000	.000140	.000045	.....	.....		
5,000	5,000	.000180	.000040	0.	.....		
6,000	6,000	.000220	.000050	.....	.....		
7,000	7,000	.000280	.000050	.....	.....		
8,000	8,000	.000335	.000055	.....	.....		
9,000	9,000	.000385	.000050	.....	.....		
10,000	10,000	.000440	.000055	0.	.....		
11,000	11,000	.000495	.000055	.....	.....		
12,000	12,000	.000545	.000050	.000015	.000015		
13,000	13,000	.000605	.000060	.....	.....		
14,000	14,000	.000660	.000055	.000040	.000025		
15,000	15,000	.000740	.000080	.....	.....		
16,000	16,000	.000800	.000080	.000055	.000015		
17,000	17,000	.000860	.000080	.....	.....		
18,000	18,000	.000915	.000085	.000095	.000040		
19,000	19,000	.001015	.000070	.....	.....		
20,000	20,000	.001100	.000085	.000145	.000050		
21,000	21,000	.001200	.000100	.....	.....		
22,000	22,000	.001285	.000085	.000205	.000060		
23,000	23,000	.001405	.000120	.....	.....		
24,000	24,000	.001515	.000110	.000325	.000120		
25,000	25,000	.001690	.000175	.000450	.000105		
28,650	28,650	.....	.....	.....	.....		Tensile strength.

Fractured ".3 from neck. Appearance, granular.

No. 1082.

Marks, <sup>12</sup> M R<sub>11</sub> T B<sub>2</sub>  
<sup>B T<sub>12</sub></sup>  
 Length, 10'.5.  
 Diameter, 1".129.  
 Sectional area, 1 square inch.  
 Gauged length, 5'.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.00004	.00004			
3,000	3,000	.00008	.00004			
4,000	4,000	.00014	.00006			
5,000	5,000	.00018	.00011	0.		
6,000	6,000	.00024	.00016			
7,000	7,000	.00028	.00021			
8,000	8,000	.00032	.00026			
9,000	9,000	.00036	.00031			
10,000	10,000	.00044	.00038	.00002	.00002	
11,000	11,000	.00048	.00044			
12,000	12,000	.00054	.00050			
13,000	13,000	.00058	.00054			
14,000	14,000	.00064	.00058			
15,000	15,000	.00072	.00068	.00001	.00002	
16,000	16,000	.00076	.00074			
17,000	17,000	.00082	.00080			
18,000	18,000	.00088	.00086			
19,000	19,000	.00094	.00092			
20,000	20,000	.00100	.00096	.00008	.00004	
21,000	21,000	.00106	.00102			
22,000	22,000	.00114	.00108			
23,000	23,000	.00122	.00114			
24,000	24,000	.00128	.00120			
25,000	25,000	.00136	.00128	.00018	.00010	
26,000	26,000	.00146	.00138			
27,000	27,000	.00154	.00148			
28,000	28,000	.00164	.00160			
29,000	29,000	.00174	.00170			
30,000	30,000	.00186	.00182	.00011	.00006	
31,000	31,000	.00200	.00194			
32,000	32,000	.00212	.00202			
33,000	33,000	.00222	.00212			
34,000	34,000	.00238	.00226			
35,000	35,000	.00286	.00228	.00116	.00072	
36,000	36,000	.00306	.00220			
37,000	37,000	.00328	.00222			
38,000	38,000	.00360	.00222			
39,000	39,000	.00404	.00244			
40,000	40,000	.00450	.00246	.00256	.00140	
41,000	41,000	.00518	.00268			
42,000	42,000	.00558	.00300			
43,000	43,000	.00596	.00332			
44,000	44,000	.00652	.00362			
45,000	45,000	.00710	.00358	.00486	.00230	
46,000	46,000	.00732	.00322			
47,000	47,000	.00820	.00388			
48,000	48,000	.00860	.00440			
49,000	49,000	.00932	.00472			
50,000	50,000	.00980	.00448	.00726	.00340	
61,700	61,700					Ultimate strength.

Failed by triple flexure.

No. 1083.

Marks, <sup>12</sup>M R<sub>1</sub> T R<sub>2</sub>  
H R<sub>2</sub>

Length, 10'' .5.

Diameter, 1'' .129.

Sectional area, 1 square inch.

Gauged length, 5''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0.	0.	0.		
2,000	2,000	.00004	.00004	.....	.....		
3,000	3,000	.00010	.00008	.....	.....		
4,000	4,000	.00014	.00004	.....	.....		
5,000	5,000	.00018	.00004	0.	.....		
6,000	6,000	.00022	.00004	.....	.....		
7,000	7,000	.00026	.00004	.....	.....		
8,000	8,000	.00030	.00004	.....	.....		
9,000	9,000	.00036	.00006	.....	.....		
10,000	10,000	.00042	.00006	0.	.....		
11,000	11,000	.00048	.00006	.....	.....		
12,000	12,000	.00052	.00004	.....	.....		
13,000	13,000	.00060	.00008	.....	.....		
14,000	14,000	.00066	.00006	.....	.....		
15,000	15,000	.00070	.00004	.00002	.00002		
16,000	16,000	.00076	.00006	.....	.....		
17,000	17,000	.00082	.00006	.....	.....		
18,000	18,000	.00088	.00006	.....	.....		
19,000	19,000	.00094	.00006	.....	.....		
20,000	20,000	.00100	.00008	.00010	.00008		
21,000	21,000	.00106	.00008	.....	.....		
22,000	22,000	.00112	.00006	.....	.....		
23,000	23,000	.00120	.00008	.....	.....		
24,000	24,000	.00128	.00008	.....	.....		
25,000	25,000	.00136	.00008	.00020	.00010		
26,000	26,000	.00142	.00006	.....	.....		
27,000	27,000	.00152	.00010	.....	.....		
28,000	28,000	.00162	.00010	.....	.....		
29,000	29,000	.00172	.00010	.....	.....		
30,000	30,000	.00186	.00014	.00046	.00026		
31,000	31,000	.00208	.00022	.....	.....		
32,000	32,000	.00224	.00016	.....	.....		
33,000	33,000	.00240	.00016	.....	.....		
34,000	34,000	.00250	.00020	.....	.....		
35,000	35,000	.00300	.00040	.00130	.00084		
36,000	36,000	.00330	.00036	.....	.....		
37,000	37,000	.00366	.00030	.....	.....		
38,000	38,000	.00404	.00038	.....	.....		
39,000	39,000	.00450	.00046	.....	.....		
40,000	40,000	.00490	.00040	.00292	.00162		
41,000	41,000	.00530	.00040	.....	.....		
42,000	42,000	.00580	.00050	.....	.....		
43,000	43,000	.00630	.00050	.....	.....		
44,000	44,000	.00690	.00060	.....	.....		
45,000	45,000	.00740	.00050	.00516	.00224		
46,000	46,000	.00794	.00054	.....	.....		
47,000	47,000	.00850	.00056	.....	.....		
48,000	48,000	.00884	.00034	.....	.....		
49,000	49,000	.00936	.00052	.....	.....		
50,000	50,000	.00982	.00046	.00738	.00222		
60,880	60,880	.....	.....	.....	.....		Ultimate strength.

Failed by triple flexure.

No. 1084.

Marks, <sup>12</sup>M B<sub>1</sub>, T B<sub>1</sub>,  
<sup>M</sup><sub>1</sub><sup>11</sup>  
 Length, 10''<sup>5</sup>/<sub>16</sub>.  
 Diameter, 1''<sup>129</sup>/<sub>16</sub>.  
 Sectional area, 1 square inch.  
 Gauged length, 5''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.00004	.00004	.....	.....	
3,000	3,000	.00008	.00004	.....	.....	
4,000	4,000	.00012	.00004	.....	.....	
5,000	5,000	.00018	.00006	0.	.....	
6,000	6,000	.00022	.00004	.....	.....	
7,000	7,000	.00026	.00004	.....	.....	
8,000	8,000	.00030	.00004	.....	.....	
9,000	9,000	.00036	.00006	.....	.....	
10,000	10,000	.00040	.00004	0.	.....	
11,000	11,000	.00046	.00006	.....	.....	
12,000	12,000	.00050	.00004	.....	.....	
13,000	13,000	.00056	.00006	.....	.....	
14,000	14,000	.00062	.00006	.....	.....	
15,000	15,000	.00068	.00006	.00002	.00002	
16,000	16,000	.00072	.00004	.....	.....	
17,000	17,000	.00078	.00006	.....	.....	
18,000	18,000	.00086	.00008	.....	.....	
19,000	19,000	.00090	.00004	.....	.....	
20,000	20,000	.00096	.00006	.00008	.00006	
21,000	21,000	.00104	.00008	.....	.....	
22,000	22,000	.00110	.00006	.....	.....	
23,000	23,000	.00116	.00006	.....	.....	
24,000	24,000	.00122	.00006	.....	.....	
25,000	25,000	.00130	.00008	.00018	.00010	
26,000	26,000	.00140	.00010	.....	.....	
27,000	27,000	.00148	.00008	.....	.....	
28,000	28,000	.00158	.00010	.....	.....	
29,000	29,000	.00166	.00010	.....	.....	
30,000	30,000	.00176	.00010	.00038	.00020	
31,000	31,000	.00192	.00014	.....	.....	
32,000	32,000	.00202	.00010	.....	.....	
33,000	33,000	.00220	.00018	.....	.....	
34,000	34,000	.00240	.00020	.....	.....	
35,000	35,000	.00262	.00022	.00096	.00058	
36,000	36,000	.00292	.00030	.....	.....	
37,000	37,000	.00326	.00034	.....	.....	
38,000	38,000	.00360	.00034	.....	.....	
39,000	39,000	.00410	.00050	.....	.....	
40,000	40,000	.00460	.00050	.00262	.00166	
41,000	41,000	.00528	.00068	.....	.....	
42,000	42,000	.00572	.00044	.....	.....	
43,000	43,000	.00630	.00058	.....	.....	
44,000	44,000	.00698	.00068	.....	.....	
45,000	45,000	.00772	.00074	.00542	.00280	
46,000	46,000	.00854	.00082	.....	.....	
47,000	47,000	.00922	.00088	.....	.....	
48,000	48,000	.01030	.00108	.....	.....	
49,000	49,000	.01140	.00120	.....	.....	
50,000	50,000	.01280	.00140	.00996	.00454	
59,440	59,440	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

## BODY NO. 22.

No. 4688.

Marks, <sup>12 M R, T R,</sup>  
<sub>B T,</sub>

Diameter, 1", 129.

Sectional area, 1 square inch.

Length of stem, 23".

Gauged length, 20".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.000060	.000060			
3,000	3,000	.000110	.000050			
4,000	4,000	.000165	.000057			
5,000	5,000	.000225	.000060	.000010	.000010	
6,000	6,000	.000280	.000055			
7,000	7,000	.000335	.000055			
8,000	8,000	.000395	.000060			
9,000	9,000	.000460	.000065			
10,000	10,000	.000515	.000055	.000025	.000015	
11,000	11,000	.000580	.000065			
12,000	12,000	.000645	.000065	.000050	.000025	
13,000	13,000	.000720	.000075			
14,000	14,000	.000795	.000075	.000075	.000025	
15,000	15,000	.000870	.000075			
16,000	16,000	.000950	.000090	.000130	.000055	
17,000	17,000	.001055	.000095			
18,000	18,000	.001165	.000110	.000200	.000070	
19,000	19,000	.001280	.000115			
20,000	20,000	.001425	.000145	.000325	.000125	
21,000	21,000	.001580	.000155			
22,000	22,000	.001790	.000210	.000545	.000220	
23,000	23,000	.002000	.000210			
24,000	24,000	.002300	.000300	.000810	.000365	
25,000	25,000	.002700	.000400	.001225	.000315	
27,690	27,690					

Fractured 11".4 from neck. Appearance, granular.

No. 4689.

Marks, <sup>12 M R, T B,</sup>  
<sub>M T,</sub>

Diameter, 1".129.

Sectional area, 1 square inch.

Length of stem, 23".

Gauged length, 20".

Applied loads.		Elongation.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.000050	.000050	.....	.....	
3,000	3,000	.000100	.000050	.....	.....	
4,000	4,000	.000155	.000055	.....	.....	
5,000	5,000	.000205	.000050	.000005	.000005	
6,000	6,000	.000255	.000050	.....	.....	
7,000	7,000	.000305	.000050	.....	.....	
8,000	8,000	.000355	.000050	.....	.....	
9,000	9,000	.000415	.000060	.....	.....	
10,000	10,000	.000470	.000055	.000015	.000010	
11,000	11,000	.000540	.000070	.....	.....	
12,000	12,000	.000595	.000055	.000045	.000030	
13,000	13,000	.000660	.000065	.....	.....	
14,000	14,000	.000720	.000060	.000060	.000015	
15,000	15,000	.000790	.000070	.....	.....	
16,000	16,000	.000855	.000065	.000100	.000040	
17,000	17,000	.000945	.000090	.....	.....	
18,000	18,000	.001015	.000070	.000145	.000045	
19,000	19,000	.001105	.000090	.....	.....	
20,000	20,000	.001200	.000095	.000210	.000065	
21,000	21,000	.001310	.000110	.....	.....	
22,000	22,000	.001450	.000140	.000330	.000120	
23,000	23,000	.001595	.000145	.....	.....	
24,000	24,000	.001760	.000165	.000510	.000180	
25,000	25,000	.001975	.000215	.000670	.000160	
28,720	28,720	.....	.....	.....	.....	Tensile strength.

Fractured ".5 from neck. Appearance, granular.

No. 1054.

Marks,  $12 \text{ M R. T R.}$   
 $\text{B 1.}$ Length,  $10'' .5$ .Diameter,  $1'' .129$ .

Sectional area, 1 square inch.

Gauged length,  $5''$ .

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0.	0.	0.		
2,000	2,000	.00004	.00004				
3,000	3,000	.00008	.00004				
4,000	4,000	.00014	.00006				
5,000	5,000	.00020	.00006	0.			
6,000	6,000	.00026	.00006				
7,000	7,000	.00032	.00006				
8,000	8,000	.00038	.00006				
9,000	9,000	.00046	.00006				
10,000	10,000	.00052	.00006	.00002	.00002		
11,000	11,000	.00058	.00006				
12,000	12,000	.00064	.00006				
13,000	13,000	.00070	.00006				
14,000	14,000	.00076	.00006				
15,000	15,000	.00082	.00006	.00006	.00004		
16,000	16,000	.00088	.00006				
17,000	17,000	.00094	.00006				
18,000	18,000	.00100	.00006				
19,000	19,000	.00106	.00006				
20,000	20,000	.00114	.00008	.00014	.00008		
21,000	21,000	.00122	.00008				
22,000	22,000	.00128	.00008				
23,000	23,000	.00136	.00008				
24,000	24,000	.00146	.00010				
25,000	25,000	.00156	.00010	.00028	.00014		
26,000	26,000	.00170	.00014				
27,000	27,000	.00184	.00014				
28,000	28,000	.00196	.00012				
29,000	29,000	.00216	.00020				
30,000	30,000	.00236	.00020	.00082	.00064		
31,000	31,000	.00256	.00020				
32,000	32,000	.00290	.00034				
33,000	33,000	.00314	.00024				
34,000	34,000	.00354	.00040				
35,000	35,000	.00402	.00048	.00220	.00138		
36,000	36,000	.00434	.00032				
37,000	37,000	.00472	.00038				
38,000	38,000	.00530	.00058				
39,000	39,000	.00584	.00054				
40,000	40,000	.00632	.00048	.00424	.00204		
41,000	41,000	.00684	.00062				
42,000	42,000	.00738	.00054				
43,000	43,000	.00800	.00062				
44,000	44,000	.00850	.00050				
45,000	45,000	.00912	.00062	.00674	.00250		
46,000	46,000	.00950	.00038				
47,000	47,000	.00994	.00044				
48,000	48,000	.01034	.00040				
49,000	49,000	.01070	.00036				
50,000	50,000	.01106	.00036	.00654	.00180		
58,100	58,100						Ultimate strength.

Failed by triple flexure.



No. 1055.

Marks, <sup>12 M R<sub>2</sub> T R<sub>2</sub></sup>  
<sub>B R<sub>10</sub></sub>  
 Length, 10' 5".  
 Diameter, 1" .129.  
 Sectional area, 1 square inch.  
 Gauged length, 5'.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0.	0.	0.		
2,000	2,000	.00004	.00004				
3,000	3,000	.00010	.00006				
4,000	4,000	.00016	.00006				
5,000	5,000	.00024	.00008	.00002	.00002		
6,000	6,000	.00030	.00006				
7,000	7,000	.00034	.00004				
8,000	8,000	.00042	.00008				
9,000	9,000	.00048	.00006				
10,000	10,000	.00052	.00004	.00004	.00002		
11,000	11,000	.00058	.00006				
12,000	12,000	.00064	.00006				
13,000	13,000	.00070	.00006				
14,000	14,000	.00076	.00006				
15,000	15,000	.00080	.00004	.00008	.00004		
16,000	16,000	.00088	.00008				
17,000	17,000	.00094	.00006				
18,000	18,000	.00100	.00006				
19,000	19,000	.00106	.00006				
20,000	20,000	.00112	.00006	.00016	.00008		
21,000	21,000	.00120	.00008				
22,000	22,000	.00128	.00008				
23,000	23,000	.00134	.00006				
24,000	24,000	.00142	.00008				
25,000	25,000	.00152	.00010	.00030	.00014		
26,000	26,000	.00166	.00014				
27,000	27,000	.00178	.00012				
28,000	28,000	.00188	.00010				
29,000	29,000	.00198	.00010				
30,000	30,000	.00230	.00022	.00008	.00038		
31,000	31,000	.00248	.00028				
32,000	32,000	.00276	.00028				
33,000	33,000	.00310	.00034				
34,000	34,000	.00352	.00042				
35,000	35,000	.00402	.00050	.00224	.00156		
36,000	36,000	.00442	.00040				
37,000	37,000	.00490	.00048				
38,000	38,000	.00532	.00042				
39,000	39,000	.00602	.00070				
40,000	40,000	.00662	.00060	.00456	.00232		
41,000	41,000	.00710	.00048				
42,000	42,000	.00756	.00046				
43,000	43,000	.00824	.00068				
44,000	44,000	.00894	.00070				
45,000	45,000	.00972	.00078	.00734	.00278		
46,000	46,000	.01020	.00048				
47,000	47,000	.01068	.00048				
48,000	48,000	.01142	.00074				
49,000	49,000	.01214	.00072				
50,000	50,000	.01310	.00096	.01040	.00306		
57,980	57,980						Ultimate strength.

Failed by triple flexure.

No. 1056.

Marks, <sup>12 M R<sub>7</sub> T R<sub>3</sub></sup>  
<sub>M T<sub>1</sub></sub>  
 Length, 10' .5.  
 Diameter, 1'' .129.  
 Sectional area, 1 square inch.  
 Gauged length, 5''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.00004	.00004			
3,000	3,000	.00010	.00006			
4,000	4,000	.00014	.00004			
5,000	5,000	.00020	.00006	0.		
6,000	6,000	.00026	.00006			
7,000	7,000	.00032	.00006			
8,000	8,000	.00040	.00008			
9,000	9,000	.00044	.00004			
10,000	10,000	.00050	.00006	.00002	.00002	
11,000	11,000	.00056	.00006			
12,000	12,000	.00062	.00006			
13,000	13,000	.00068	.00006			
14,000	14,000	.00072	.00004			
15,000	15,000	.00078	.00006	.00006	.00004	
16,000	16,000	.00084	.00006			
17,000	17,000	.00090	.00006			
18,000	18,000	.00096	.00006			
19,000	19,000	.00102	.00006			
20,000	20,000	.00108	.00006	.00012	.00006	
21,000	21,000	.00116	.00008			
22,000	22,000	.00124	.00008			
23,000	23,000	.00130	.00006			
24,000	24,000	.00140	.00010			
25,000	25,000	.00148	.00008	.00028	.00016	
26,000	26,000	.00158	.00010			
27,000	27,000	.00168	.00010			
28,000	28,000	.00180	.00012			
29,000	29,000	.00192	.00012			
30,000	30,000	.00210	.00018	.00066	.00038	
31,000	31,000	.00236	.00026			
32,000	32,000	.00258	.00022			
33,000	33,000	.00290	.00032			
34,000	34,000	.00316	.00026			
35,000	35,000	.00352	.00030	.00180	.00114	
36,000	36,000	.00386	.00034			
37,000	37,000	.00422	.00036			
38,000	38,000	.00464	.00042			
39,000	39,000	.00514	.00050			
40,000	40,000	.00560	.00046	.00366	.00186	
41,000	41,000	.00600	.00040			
42,000	42,000	.00628	.00028			
43,000	43,000	.00660	.00032			
44,000	44,000	.00690	.00030			
45,000	45,000	.00716	.00026	.00506	.00140	
46,000	46,000	.00734	.00018			
47,000	47,000	.00744	.00010			
48,000	48,000	.00748	.00004			
49,000	49,000	.00760	.00012			
50,000	50,000	.00768	.00008	.00562	.00056	
54,910	54,910					

Defects; convex on the micrometer side.

Ultimate strength.

Failed by triple flexure.

BODY No. 22 (second casting).

No. 4753.

Marks, <sup>12</sup>M R., T R.,Diameter, <sup>BT</sup>1<sup>11</sup>/<sub>16</sub> .129.

Sectional area, 1 square inch.

Length of stem, 23<sup>11</sup>/<sub>16</sub>.Gauged length, 20<sup>11</sup>/<sub>16</sub>.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.000055	.000055	.....	.....	
3,000	3,000	.000105	.000050	.....	.....	
4,000	4,000	.000155	.000050	.....	.....	
5,000	5,000	.000210	.000055	.000005	.000005	
6,000	6,000	.000265	.000055	.....	.....	
7,000	7,000	.000315	.000050	.....	.....	
8,000	8,000	.000365	.000050	.....	.....	
9,000	9,000	.000430	.000065	.....	.....	
10,000	10,000	.000495	.000065	.000035	.000030	
11,000	11,000	.000550	.000055	.....	.....	
12,000	12,000	.000610	.000060	.000050	.000015	
13,000	13,000	.000690	.000080	.....	.....	
14,000	14,000	.000760	.000070	.000070	.000020	
15,000	15,000	.000845	.000085	.....	.....	
16,000	16,000	.000940	.000095	.000210	.000040	
17,000	17,000	.001010	.000070	.....	.....	
18,000	18,000	.001100	.000090	.000175	.000065	
19,000	19,000	.001205	.000105	.....	.....	
20,000	20,000	.001335	.000130	.000260	.000085	
21,000	21,000	.001480	.000145	.....	.....	
22,000	22,000	.001640	.000160	.000415	.000155	
23,000	23,000	.001880	.000240	.....	.....	
24,000	24,000	.002100	.000220	.....	.....	
						Tensile strength.

Fractured 5<sup>11</sup>/<sub>16</sub> from neck. Appearance, granular, with coarse spangles.

No. 4754.

Marks, <sup>12 M R<sub>22</sub> T R<sub>1</sub></sup>  
<sub>M T<sub>11</sub></sub>

Diameter, 1".129.

Sectional area, 1 square inch.

Length of stem, 23".

Gauged length, 20".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.000050	.000050			
3,000	3,000	.000100	.000050			
4,000	4,000	.000150	.000050			
5,000	5,000	.000200	.000050	0.		
6,000	6,000	.000245	.000015			
7,000	7,000	.000295	.000050			
8,000	8,000	.000345	.000050			
9,000	9,000	.000395	.000050			
10,000	10,000	.000450	.000055	.000010	.000010	
11,000	11,000	.000500	.000050			
12,000	12,000	.000560	.000060	.000030	.000020	
13,000	13,000	.000615	.000055			
14,000	14,000	.000690	.000075	.000050	.000020	
15,000	15,000	.000750	.000060			
16,000	16,000	.000810	.000060	.000070	.000020	
17,000	17,000	.000925	.000115			
18,000	18,000	.000990	.000065	.000110	.000040	
19,000	19,000	.001045	.000055			
20,000	20,000	.001140	.000095	.000160	.000050	
21,000	21,000	.001240	.000160			
22,000	22,000	.001355	.000115	.000280	.000100	
23,000	21,000	.001500	.000145			
24,000	24,000	.001660	.000160	.000445	.000185	
25,000	25,000	.001900	.000240	.000630	.000155	
28,150	28,150					Tensile strength.

Fractured 1".1 from neck. Appearance, granular.

No. 1085.

Marks, 12 M R<sub>1</sub> T R<sub>2</sub>

Length, 10'<sup>5</sup>/<sub>8</sub>"

Diameter, 1".129.

Sectional area, 1 square inch.

Gauged length, 5".

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00004	.00004	.....	.....	
3,000	3,000	.00010	.00008	.....	.....	
4,000	4,000	.00014	.00004	.....	.....	
5,000	5,000	.00020	.00008	0.	.....	
6,000	6,000	.00024	.00004	.....	.....	
7,000	7,000	.00030	.00008	.....	.....	
8,000	8,000	.00034	.00004	.....	.....	
9,000	9,000	.00040	.00008	.....	.....	
10,000	10,000	.00046	.00008	0.	.....	
11,000	11,000	.00052	.00008	.....	.....	
12,000	12,000	.00058	.00008	.....	.....	
13,000	13,000	.00062	.00004	.....	.....	
14,000	14,000	.00068	.00008	.....	.....	
15,000	15,000	.00074	.00008	.00004	.00004	
16,000	16,000	.00078	.00004	.....	.....	
17,000	17,000	.00084	0.0005	.....	.....	
18,000	18,000	.00090	.00008	.....	.....	
19,000	19,000	.00098	.00008	.....	.....	
20,000	20,000	.00104	.00008	.00010	.00006	
21,000	21,000	.00110	.00008	.....	.....	
22,000	22,000	.00116	.00008	.....	.....	
23,000	23,000	.00124	.00008	.....	.....	
24,000	24,000	.00130	.00008	.....	.....	
25,000	25,000	.00140	.00010	.00022	.00012	
26,000	26,000	.00148	.00008	.....	.....	
27,000	27,000	.00156	.00008	.....	.....	
28,000	28,000	.00168	.00012	.....	.....	
29,000	29,000	.00178	.00010	.....	.....	
30,000	30,000	.00194	.00016	.00050	.00028	
31,000	31,000	.00210	.00016	.....	.....	
32,000	32,000	.00226	.00016	.....	.....	
33,000	33,000	.00248	.00022	.....	.....	
34,000	34,000	.00266	.00018	.....	.....	
35,000	35,000	.00306	.00040	.00132	.00082	
36,000	36,000	.00330	.00024	.....	.....	
37,000	37,000	.00356	.00026	.....	.....	
38,000	38,000	.00400	.00044	.....	.....	
39,000	39,000	.00444	.00044	.....	.....	
40,000	40,000	.00494	.00050	.00206	.00164	
41,000	41,000	.00534	.00040	.....	.....	
42,000	42,000	.00586	.00052	.....	.....	
43,000	43,000	.00636	.00050	.....	.....	
44,000	44,000	.00676	.00040	.....	.....	
45,000	45,000	.00744	.00068	.00518	.00220	
46,000	46,000	.00790	.00046	.....	.....	
47,000	47,000	.00840	.00050	.....	.....	
48,000	48,000	.00876	.00036	.....	.....	
49,000	49,000	.00912	.00036	.....	.....	
50,000	50,000	.00950	.00038	.00704	.00188	
60,280	60,280	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

No. 1086.

Marks, <sup>12</sup>M R<sub>7</sub> T B<sub>3</sub>

<sup>B L</sup>30

Length, 10<sup>1</sup>/<sub>5</sub>.

Diameter, 1<sup>1</sup>/<sub>129</sub>.

Sectional area, 1 square inch.

Gauged length, 5<sup>1</sup>/<sub>2</sub>.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.0004	.0004			
3,000	3,000	.0010	.0006			
4,000	4,000	.0014	.0004			
5,000	5,000	.0020	.0006	0.		
6,000	6,000	.0026	.0006			
7,000	7,000	.0030	.0034			
8,000	8,000	.0036	.0006			
9,000	9,000	.0040	.0034			
10,000	10,000	.0046	.0006	0.		
11,000	11,000	.0050	.0004			
12,000	12,000	.0051	.0004			
13,000	13,000	.0060	.0006			
14,000	14,000	.0066	.0006			
15,000	15,000	.0072	.0006	.0004	.0004	
16,000	16,000	.0076	.0004			
17,000	17,000	.0082	.0006			
18,000	18,000	.0086	.0008			
19,000	19,000	.0096	.0006			
20,000	20,000	.00100	.0004	.0010	.0003	
21,000	21,000	.00108	.0008			
22,000	22,000	.00114	.0006			
23,000	23,000	.00122	.0008			
24,000	24,000	.00128	.0006			
25,000	25,000	.00134	.0006	.00020	.00010	
26,000	26,000	.00144	.0010			
27,000	27,000	.00152	.0008			
28,000	28,000	.00162	.0010			
29,000	29,000	.00176	.0004			
30,000	30,000	.00190	.0004	.00018	.00028	
31,000	31,000	.00204	.0004			
32,000	32,000	.00222	.0008			
33,000	33,000	.00248	.0026			
34,000	34,000	.00272	.0024			
35,000	35,000	.00310	.0038	.00120	.00072	
36,000	36,000	.00342	.0032			
37,000	37,000	.00368	.0026			
38,000	38,000	.00422	.0054			
39,000	39,000	.00470	.0048			
40,000	40,000	.00514	.0044	.00318	.00198	
41,000	41,000	.00576	.0032			
42,000	42,000	.00632	.0056			
43,000	43,000	.00686	.0054			
44,000	44,000	.00744	.0058			
45,000	45,000	.00810	.0086	.00606	.00288	
46,000	46,000	.00886	.0046			
47,000	47,000	.00936	.0050			
48,000	48,000	.01010	.0080			
49,000	49,000	.01118	.00102			
50,000	50,000	.01222	.00104	.00350	.00344	
60,040	60,040					Ultimate strength.

Failed by triple flexure.

No. 1087.

Marks, <sup>12</sup>M R<sub>1</sub> T R<sub>1</sub>

Length, 10' .5.

Diameter 1" .129.

Sectional area, 1 square inch.

Gauged length, 5'.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.00004	.00004			
3,000	3,000	.00010	.00006			
4,000	4,000	.00014	.00004			
5,000	5,000	.00018	.00004	0.		
6,000	6,000	.00022	.00004			
7,000	7,000	.00028	.00006			
8,000	8,000	.00032	.00004			
9,000	9,000	.00038	.00006			
10,000	10,000	.00042	.00004	0.		
11,000	11,000	.00048	.00006			
12,000	12,000	.00054	.00006			
13,000	13,000	.00060	.00006			
14,000	14,000	.00064	.00004			
15,000	15,000	.00070	.00006	.00004	.00004	
16,000	16,000	.00076	.00006			
17,000	17,000	.00082	.00006			
18,000	18,000	.00088	.00006			
19,000	19,000	.00094	.00006			
20,000	20,000	.00102	.00008	.00010	.00006	
21,000	21,000	.00108	.00006			
22,000	22,000	.00114	.00006			
23,000	23,000	.00122	.00008			
24,000	24,000	.00130	.00008			
25,000	25,000	.00138	.00008	.00020	.00010	
26,000	26,000	.00150	.00012			
27,000	27,000	.00156	.00006			
28,000	28,000	.00164	.00008			
29,000	29,000	.00178	.00014			
30,000	30,000	.00194	.00016	.00052	.00032	
31,000	31,000	.00210	.00016			
32,000	32,000	.00228	.00018			
33,000	33,000	.00252	.00024			
34,000	34,000	.00280	.00028			
35,000	35,000	.00310	.00030	.00146	.00094	
36,000	36,000	.00338	.00028			
37,000	37,000	.00380	.00042			
38,000	38,000	.00434	.00054			
39,000	39,000	.00476	.00042			
40,000	40,000	.00528	.00052	.00330	.00184	
41,000	41,000	.00572	.00044			
42,000	42,000	.00628	.00056			
43,000	43,000	.00686	.00058			
44,000	44,000	.00740	.00054			
45,000	45,000	.00810	.00070	.00582	.00252	
46,000	46,000	.00880	.00070			
47,000	47,000	.00930	.00050			
48,000	48,000	.00980	.00050			
49,000	49,000	.01040	.00060			
50,000	50,000	.01124	.00084	.00806	.00284	
60,880	60,880					Ultimate strength.

Failed by triple flexure.

BODY No. 23.

No. 4693.

Marks, <sup>12 M R T R,</sup>  
<sub>B T,</sub>  
 Diameter, 1".129.  
 Sectional area, 1 square inch.  
 Length of stem, 23".  
 Gauged length, 20".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.000050	.000050	-----	-----	
3,000	3,000	.000100	.000050	-----	-----	
4,000	4,000	.000150	.000050	-----	-----	
5,000	5,000	.000200	.000050	0.	-----	
6,000	6,000	.000250	.000050	-----	-----	
7,000	7,000	.000305	.000055	-----	-----	
8,000	8,000	.000360	.000055	-----	-----	
9,000	9,000	.000420	.000060	-----	-----	
10,000	10,000	.000485	.000065	.000010	.000010	
11,000	11,000	.000550	.000065	-----	-----	
12,000	12,000	.000610	.000060	.000040	.000030	
13,000	13,000	.000690	.000080	-----	-----	
14,000	14,000	.000755	.000085	.000055	.000015	
15,000	15,000	.000850	.000085	-----	-----	
16,000	16,000	.000935	.000085	.000105	.000050	
17,000	17,000	.001040	.000105	-----	-----	
18,000	18,000	.001150	.000110	.000190	.000085	
19,000	19,000	.001285	.000115	-----	-----	
20,000	20,000	.001425	.000160	.000315	.000125	
21,000	21,000	.001575	.000150	-----	-----	
22,000	22,000	.001790	.000215	.000540	.000225	
23,000	23,000	.002125	.000335	-----	-----	
24,000	24,000	.002450	.000225	.000945	.000405	
25,000	25,000	.002715	.000365	.001240	.000295	
25,010	25,010	-----	-----	-----	-----	Tensile strength.

Fractured 4".9 from neck. Appearance, granular.



No. 4694.

Marks, <sup>12 M R<sub>77</sub> T R<sub>1</sub></sup>  
<sub>M T<sub>1</sub></sub>  
 Diameter, 1".129.  
 Sectional area, 1 square inch.  
 Length of stem, 23".  
 Gauged length, 20".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.000050	.000050	.....	.....	
3,000	3,000	.000100	.000050	.....	.....	
4,000	4,000	.000150	.000050	.....	.....	
5,000	5,000	.000200	.000050	0.	.....	
6,000	6,000	.000255	.000055	.....	.....	
7,000	7,000	.000300	.000045	.....	.....	
8,000	8,000	.003355	.000055	.....	.....	
9,000	9,000	.000410	.000055	.....	.....	
10,000	10,000	.000490	.000050	.000010	.000010	
11,000	11,000	.000525	.000065	.....	.....	
12,000	12,000	.000590	.000065	.000030	.000020	
13,000	13,000	.000650	.000060	.....	.....	
14,000	14,000	.000710	.000060	.000050	.000020	
15,000	15,000	.000795	.000085	.....	.....	
16,000	16,000	.000855	.000060	.000090	.000040	
17,000	17,000	.000945	.000080	.....	.....	
18,000	18,000	.001025	.000080	.000140	.000050	
19,000	19,000	.001110	.000085	.....	.....	
20,000	20,000	.001225	.000115	.000200	.000060	
21,000	21,000	.001250	.000125	.....	.....	
22,000	22,000	.001470	.000120	.000320	.000120	
23,000	23,000	.001650	.000180	.....	.....	
24,000	24,000	.001800	.000150	.000505	.000185	
25,000	25,000	.002060	.000200	.000700	.000195	
28,020	28,020	.....	.....	.....	.....	Tensile strength.

Fractured 10".6 from neck. Appearance, granular.

H. Ex. 43—18

No. 1063.

Marks, <sup>12</sup>M R, <sup>T R</sup><sub>B T</sub>,  
 Length, 10''<sup>5</sup>.  
 Diameter, 1''<sup>129</sup>.  
 Sectional area, 1 square inch.  
 Gauged length, 5''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00004	.00004	.....	.....	
3,000	3,000	.00006	.00004	.....	.....	
4,000	4,000	.00012	.00004	.....	.....	
5,000	5,000	.00018	.00006	0.	.....	
6,000	6,000	.00022	.00004	.....	.....	
7,000	7,000	.00028	.00006	.....	.....	
8,000	8,000	.00034	.00006	.....	.....	
9,000	9,000	.00038	.00004	.....	.....	
10,000	10,000	.00044	.00006	.00002	.00002	
11,000	11,000	.00050	.00006	.....	.....	
12,000	12,000	.00056	.00006	.....	.....	
13,000	13,000	.00062	.00006	.....	.....	
14,000	14,000	.00070	.00008	.....	.....	
15,000	15,000	.00074	.00004	.00010	.00008	
16,000	16,000	.00082	.00008	.....	.....	
17,000	17,000	.00088	.00006	.....	.....	
18,000	18,000	.00094	.00006	.....	.....	
19,000	19,000	.00100	.00006	.....	.....	
20,000	20,000	.00106	.00006	.00016	.00006	
21,000	21,000	.00112	.00006	.....	.....	
22,000	22,000	.00120	.00008	.....	.....	
23,000	23,000	.00128	.00008	.....	.....	
24,000	24,000	.00134	.00006	.....	.....	
25,000	25,000	.00142	.00008	.00030	.00014	
26,000	26,000	.00152	.00010	.....	.....	
27,000	27,000	.00160	.00008	.....	.....	
28,000	28,000	.00170	.00010	.....	.....	
29,000	29,000	.00182	.00012	.....	.....	
30,000	30,000	.00196	.00014	.00054	.00024	
31,000	31,000	.00214	.00016	.....	.....	
32,000	32,000	.00228	.00014	.....	.....	
33,000	33,000	.00252	.00024	.....	.....	
34,000	34,000	.00278	.00026	.....	.....	
35,000	35,000	.00306	.00028	.00138	.00084	
36,000	36,000	.00344	.00038	.....	.....	
37,000	37,000	.00374	.00030	.....	.....	
38,000	38,000	.00418	.00044	.....	.....	
39,000	39,000	.00462	.00044	.....	.....	
40,000	40,000	.00500	.00038	.00308	.00170	
41,000	41,000	.00560	.00060	.....	.....	
42,000	42,000	.00594	.00034	.....	.....	
43,000	43,000	.00640	.00046	.....	.....	
44,000	44,000	.00698	.00058	.....	.....	
45,000	45,000	.00754	.00056	.00530	.00222	
46,000	46,000	.00800	.00046	.....	.....	
47,000	47,000	.00840	.00040	.....	.....	
48,000	48,000	.00884	.00044	.....	.....	
49,000	49,000	.00938	.00054	.....	.....	
50,000	50,000	.00980	.00042	.00734	.00204	
59,570	59,570	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

No. 1064.

Marks, <sup>12 M R<sub>2</sub> T R<sub>2</sub></sup>  
<sub>B R<sub>2</sub></sub>

Length, 10' 5".

Diameter, 1" .129.

Sectional area, 1 square inch.

Gauged length, 5'.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.00004	.00004	.....	.....	
3,000	3,000	.00008	.00004	.....	.....	
4,000	4,000	.00014	.00006	.....	.....	
5,000	5,000	.00018	.00004	0.	.....	
6,000	6,000	.00024	.00006	.....	.....	
7,000	7,000	.00028	.00004	.....	.....	
8,000	8,000	.00034	.00006	.....	.....	
9,000	9,000	.00038	.00004	.....	.....	
10,000	10,000	.00044	.00006	.00002	.00002	
11,000	11,000	.00050	.00006	.....	.....	
12,000	12,000	.00056	.00006	.....	.....	
13,000	13,000	.00060	.00004	.....	.....	
14,000	14,000	.00064	.00004	.....	.....	
15,000	15,000	.00070	.00006	.00006	.00004	
16,000	16,000	.00076	.00006	.....	.....	
17,000	17,000	.00082	.00006	.....	.....	
18,000	18,000	.00090	.00008	.....	.....	
19,000	19,000	.00094	.00004	.....	.....	
20,000	20,000	.00102	.00008	.00012	.00006	
21,000	21,000	.00110	.00008	.....	.....	
22,000	22,000	.00116	.00006	.....	.....	
23,000	23,000	.00122	.00006	.....	.....	
24,000	24,000	.00132	.00010	.....	.....	
25,000	25,000	.00140	.00008	.00024	.00012	
26,000	26,000	.00150	.00010	.....	.....	
27,000	27,000	.00160	.00010	.....	.....	
28,000	28,000	.00170	.00010	.....	.....	
29,000	29,000	.00186	.00016	.....	.....	
30,000	30,000	.00202	.00016	.00060	.00036	
31,000	31,000	.00222	.00020	.....	.....	
32,000	32,000	.00240	.00018	.....	.....	
33,000	33,000	.00260	.00020	.....	.....	
34,000	34,000	.00296	.00036	.....	.....	
35,000	35,000	.00330	.00034	.00162	.00102	
36,000	36,000	.00376	.00046	.....	.....	
37,000	37,000	.00410	.00034	.....	.....	
38,000	38,000	.00440	.00030	.....	.....	
39,000	39,000	.00496	.00056	.....	.....	
40,000	40,000	.00554	.00058	.00358	.00196	
42,000	42,000	.00650	.00072	.....	.....	
43,000	43,000	.00722	.00072	.....	.....	
44,000	44,000	.00768	.00046	.....	.....	
45,000	45,000	.00832	.00064	.00608	.00250	
46,000	46,000	.00890	.00058	.....	.....	
47,000	47,000	.00930	.00040	.....	.....	
48,000	48,000	.00992	.00062	.....	.....	
49,000	49,000	.01070	.00078	.....	.....	
50,000	50,000	.01132	.00062	.00874	.00266	
60,560	60,560	.....	.....	.....	.....	

Ultimate strength.

Failed by triple flexure.

No. 1065.

Marks, <sup>12 M R, T R,</sup>  
<sub>M T,</sub>  
 Length, 10''<sup>5</sup>.  
 Diameter, 1''<sup>.129</sup>.  
 Sectional area, 1 square inch.  
 Gauged length, 5''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.00004	.00004	.....	.....	
3,000	3,000	.00008	.00004	.....	.....	
4,000	4,000	.00012	.00004	.....	.....	
5,000	5,000	.00018	.00006	0.	.....	
6,000	6,000	.00024	.00006	.....	.....	
7,000	7,000	.00030	.00006	.....	.....	
8,000	8,000	.00036	.00006	.....	.....	
9,000	9,000	.00040	.00004	.....	.....	
10,000	10,000	.00044	.00004	.00002	.00002	
11,000	11,000	.00050	.00006	.....	.....	
12,000	12,000	.00054	.00004	.....	.....	
13,000	13,000	.00060	.00006	.....	.....	
14,000	14,000	.00066	.00006	.....	.....	
15,000	15,000	.00072	.00006	.00004	.00002	
16,000	16,000	.00078	.00006	.....	.....	
17,000	17,000	.00082	.00004	.....	.....	
18,000	18,000	.00088	.00006	.....	.....	
19,000	19,000	.00094	.00006	.....	.....	
20,000	20,000	.00100	.00006	.00010	.00006	
21,000	21,000	.00108	.00008	.....	.....	
22,000	22,000	.00114	.00006	.....	.....	
23,000	23,000	.00122	.00008	.....	.....	
24,000	24,000	.00130	.00008	.....	.....	
25,000	25,000	.00138	.00008	.00020	.00010	
26,000	26,000	.00148	.00008	.....	.....	
27,000	27,000	.00152	.00006	.....	.....	
28,000	28,000	.00160	.00008	.....	.....	
29,000	29,000	.00178	.00016	.....	.....	
30,000	30,000	.00188	.00012	.00048	.00028	
31,000	31,000	.00202	.00014	.....	.....	
32,000	32,000	.00218	.00016	.....	.....	
33,000	33,000	.00240	.00022	.....	.....	
34,000	34,000	.00262	.00022	.....	.....	
35,000	35,000	.00294	.00032	.00128	.00080	
36,000	36,000	.00328	.00034	.....	.....	
37,000	37,000	.00356	.00028	.....	.....	
38,000	38,000	.00380	.00024	.....	.....	
39,000	39,000	.00426	.00046	.....	.....	
40,000	40,000	.00478	.00052	.00286	.00158	
41,000	41,000	.00522	.00044	.....	.....	
42,000	42,000	.00556	.00034	.....	.....	
43,000	43,000	.00582	.00036	.....	.....	
44,000	44,000	.00632	.00040	.....	.....	
45,000	45,000	.00684	.00062	.00460	.00174	
46,000	46,000	.00710	.00016	.....	.....	
47,000	47,000	.00724	.00014	.....	.....	
48,000	48,000	.00732	.00008	.....	.....	
49,000	49,000	.00738	.00006	.....	.....	
50,000	50,000	.00736	.00002	.00518	.00058	
58,400	58,400	.....	.....	.....	.....	

Defects. Micrometer on the convex side.  
 Ultimate strength.

Failed by triple flexure.

BODY No. 23 (second casting).

No. 4755.

Marks, <sup>12</sup>M R, <sup>T</sup>R,

Diameter, <sup>B T</sup>1" .129.

Sectional area, 1 square inch.

Length of stem, 23".

Gauged length, 20".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0.	0.	0.		
2,000	2,000	.000045	.000045	.....	.....		
3,000	3,000	.000090	.000045	.....	.....		
4,000	4,000	.000140	.000050	.....	.....		
5,000	5,000	.000185	.000045	0.	.....		
6,000	6,000	.000235	.000050	.....	.....		
7,000	7,000	.000285	.000050	.....	.....		
8,000	8,000	.000340	.000055	.....	.....		
9,000	9,000	.000390	.000050	.....	.....		
10,000	10,000	.000445	.000055	0.	.....		
11,000	11,000	.000505	.000060	.....	.....		
12,000	12,000	.000565	.000060	.000010	.000010		
13,000	13,000	.000640	.000075	.....	.....		
14,000	14,000	.000705	.000065	.000045	.000035		
15,000	15,000	.000785	.000080	.....	.....		
16,000	16,000	.000880	.000075	.000090	.000045		
17,000	17,000	.000955	.000085	.....	.....		
18,000	18,000	.001050	.000095	.000145	.000055		
19,000	19,000	.001150	.000100	.....	.....		
20,000	20,000	.001290	.000140	.000245	.000100		
21,000	21,000	.001410	.000120	.....	.....		
22,000	22,000	.001570	.000160	.000400	.000155		
23,000	23,000	.001775	.000205	.....	.....		
24,000	24,000	.002010	.000235	.000695	.000295		
25,000	25,000	.002315	.000305	.000905	.000210		
28,420	28,420	.....	.....	.....	.....		Tensile strength.

Fractured 2".7 from neck. Appearance, granular.

No. 4756.

Marks,  $12 M R_{11} T E_1$   
 $M T_{11}$   
 Diameter, 1".129.  
 Sectional area, 1 square inch.  
 Length of stem, 23".  
 Gauged length, 20".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.000040	.000040			
3,000	3,000	.000080	.000050			
4,000	4,000	.000140	.000050			
5,000	5,000	.000185	.000045	0.		
6,000	6,000	.000235	.000050			
7,000	7,000	.000285	.000050			
8,000	8,000	.000335	.000050			
9,000	9,000	.000390	.000055			
10,000	10,000	.000445	.000055	0.		
11,000	11,000	.000495	.000050			
12,000	12,000	.000555	.000080	.000020	.000020	
13,000	13,000	.000605	.000050			
14,000	14,000	.000665	.000060	.000025	.000065	
15,000	15,000	.000730	.000065			
16,000	16,000	.000805	.000075	.000050	.000025	
17,000	17,000	.000880	.000075			
18,000	18,000	.000945	.000065	.000095	.000045	
19,000	19,000	.001020	.000075			
20,000	20,000	.001105	.000085	.000145	.000050	
21,000	21,000	.001190	.000085			
22,000	22,000	.001300	.000110	.000205	.000060	
23,000	23,000	.001405	.000105			
24,000	24,000	.001550	.000145	.000325	.000120	
25,000	25,000	.001700	.000150	.000405	.000080	
28,890	28,890					Tensile strength.

Fractured at neck. Appearance, granular.

No. 1088.

Marks, <sup>12 M R. T B.</sup><sub>B T.</sub>  
 Length, 10''<sup>12</sup>/<sub>5</sub>.  
 Diameter, 1''<sup>129</sup>.  
 Sectional area, 1 square inch.  
 Gauged length, 5''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.00004	.00004	.....	.....	
3,000	3,000	.00008	.00004	.....	.....	
4,000	4,000	.00012	.00004	.....	.....	
5,000	5,000	.00018	.00006	0.	.....	
6,000	6,000	.00022	.00004	.....	.....	
7,000	7,000	.00026	.00004	.....	.....	
8,000	8,000	.00032	.00006	.....	.....	
9,000	9,000	.00038	.00006	.....	.....	
10,000	10,000	.00042	.00004	0.	.....	
11,000	11,000	.00048	.00006	.....	.....	
12,000	12,000	.00054	.00006	.....	.....	
13,000	13,000	.00060	.00006	.....	.....	
14,000	14,000	.00066	.00006	.....	.....	
15,000	15,000	.00072	.00006	.00002	.00002	
16,000	16,000	.00080	.00008	.....	.....	
17,000	17,000	.00086	.00006	.....	.....	
18,000	18,000	.00094	.00008	.....	.....	
19,000	19,000	.00100	.00006	.....	.....	
20,000	20,000	.00104	.00004	.00010	.00008	
21,000	21,000	.00110	.00006	.....	.....	
22,000	22,000	.00116	.00008	.....	.....	
23,000	23,000	.00124	.00006	.....	.....	
24,000	24,000	.00132	.00008	.....	.....	
25,000	25,000	.00140	.00008	.00020	.00010	
26,000	26,000	.00150	.00010	.....	.....	
27,000	27,000	.00160	.00010	.....	.....	
28,000	28,000	.00170	.00010	.....	.....	
29,000	29,000	.00182	.00012	.....	.....	
30,000	30,000	.00200	.00018	.00052	.00032	
31,000	31,000	.00216	.00016	.....	.....	
32,000	32,000	.00234	.00018	.....	.....	
33,000	33,000	.00260	.00026	.....	.....	
34,000	34,000	.00290	.00030	.....	.....	
35,000	35,000	.00314	.00024	.00140	.00068	
36,000	36,000	.00340	.00026	.....	.....	
37,000	37,000	.00370	.00030	.....	.....	
38,000	38,000	.00424	.00054	.....	.....	
39,000	39,000	.00476	.00062	.....	.....	
40,000	40,000	.00522	.00046	.00320	.00180	
41,000	41,000	.00558	.00036	.....	.....	
42,000	42,000	.00610	.00052	.....	.....	
43,000	43,000	.00686	.00076	.....	.....	
44,000	44,000	.00720	.00034	.....	.....	
45,000	45,000	.00810	.00090	.00576	.00256	
46,000	46,000	.00874	.00064	.....	.....	
47,000	47,000	.00920	.00046	.....	.....	
48,000	48,000	.00978	.00058	.....	.....	
49,000	49,000	.01042	.00064	.....	.....	
50,000	50,000	.01120	.00078	.00858	.00282	
59,720	59,720	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

No. 1089.

Marks, <sup>12 M R<sub>2</sub> T R<sub>2</sub></sup>  
<sub>B R<sub>2</sub></sub>

Length, 10'' .5.

Diameter, 1'' .129.

Sectional area, 1 square inch.

Gauged length, 5''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.00004	.00004	.....	.....	
3,000	3,000	.00010	.00006	.....	.....	
4,000	4,000	.00014	.00004	.....	.....	
5,000	5,000	.00018	.00004	0.	.....	
6,000	6,000	.00024	.00006	.....	.....	
7,000	7,000	.00028	.00004	.....	.....	
8,000	8,000	.00032	.00004	.....	.....	
9,000	9,000	.00038	.00006	.....	.....	
10,000	10,000	.00042	.00004	0.	.....	
11,000	11,000	.00048	.00006	.....	.....	
12,000	12,000	.00052	.00004	.....	.....	
13,000	13,000	.00058	.00006	.....	.....	
14,000	14,000	.00064	.00006	.....	.....	
15,000	15,000	.00070	.00006	.00002	.00002	
16,000	16,000	.00076	.00006	.....	.....	
17,000	17,000	.00082	.00006	.....	.....	
18,000	18,000	.00090	.00008	.....	.....	
19,000	19,000	.00094	.00004	.....	.....	
20,000	20,000	.00100	.00006	.00008	.00006	
21,000	21,000	.00106	.00006	.....	.....	
22,000	22,000	.00114	.00008	.....	.....	
23,000	23,000	.00122	.00008	.....	.....	
24,000	24,000	.00130	.00008	.....	.....	
25,000	25,000	.00138	.00008	.00020	.00012	
26,000	26,000	.00146	.00008	.....	.....	
27,000	27,000	.00156	.00010	.....	.....	
28,000	28,000	.00168	.00012	.....	.....	
29,000	29,000	.00180	.00012	.....	.....	
30,000	30,000	.00200	.00020	.00056	.00036	
31,000	31,000	.00216	.00016	.....	.....	
32,000	32,000	.00234	.00018	.....	.....	
33,000	33,000	.00260	.00026	.....	.....	
34,000	34,000	.00290	.00030	.....	.....	
35,000	35,000	.00332	.00042	.00160	.00104	
36,000	36,000	.00380	.00028	.....	.....	
37,000	37,000	.00400	.00040	.....	.....	
38,000	38,000	.00430	.00030	.....	.....	
39,000	39,000	.00488	.00056	.....	.....	
40,000	40,000	.00546	.00060	.00346	.00186	
41,000	41,000	.00590	.00044	.....	.....	
42,000	42,000	.00636	.00046	.....	.....	
43,000	43,000	.00690	.00054	.....	.....	
44,000	44,000	.00756	.00066	.....	.....	
45,000	45,000	.00830	.00074	.00600	.00254	
46,000	46,000	.00890	.00060	.....	.....	
47,000	47,000	.00940	.00050	.....	.....	
48,000	48,000	.01000	.00060	.....	.....	
49,000	49,000	.01092	.00092	.....	.....	
50,000	50,000	.01160	.00068	.00898	.00298	
60,320	60,320	.....	.....	.....	.....	

Failed by triple flexure.



No. 1090.

Marks, <sup>12</sup> M R<sub>11</sub> T E<sub>1</sub>

Length, 10<sup>11</sup>/<sub>16</sub>.

Diameter, 1<sup>11</sup>/<sub>16</sub>.129.

Sectional area, 1 square inch.

Gauged length, 5<sup>11</sup>/<sub>16</sub>.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0.	0.	0.		
2,000	2,000	.00004	.00004	.....	.....		
3,000	3,000	.00010	.00006	.....	.....		
4,000	4,000	.00014	.00004	.....	.....		
5,000	5,000	.00018	.00004	0.	.....		
6,000	6,000	.00022	.00004	.....	.....		
7,000	7,000	.00028	.00006	.....	.....		
8,000	8,000	.00032	.00004	.....	.....		
9,000	9,000	.00038	.00006	.....	.....		
10,000	10,000	.00042	.00004	0.	.....		
11,000	11,000	.00050	.00006	.....	.....		
12,000	12,000	.00054	.00004	.....	.....		
13,000	13,000	.00060	.00006	.....	.....		
14,000	14,000	.00064	.00034	.....	.....		
15,000	15,000	.00070	.00006	.00002	.00002		
16,000	16,000	.00076	.00036	.....	.....		
17,000	17,000	.00082	.00036	.....	.....		
18,000	18,000	.00088	.00006	.....	.....		
19,000	19,000	.00094	.00036	.....	.....		
20,000	20,000	.00100	.00006	.00008	.00006		
21,000	21,000	.00106	.00036	.....	.....		
22,000	22,000	.00112	.00036	.....	.....		
23,000	23,000	.00120	.00008	.....	.....		
24,000	24,000	.00128	.00008	.....	.....		
25,000	25,000	.00134	.00006	.00014	.00006		
26,000	26,000	.00140	.00006	.....	.....		
27,000	27,000	.00148	.00008	.....	.....		
28,000	28,000	.00156	.00008	.....	.....		
29,000	29,000	.00166	.00010	.....	.....		
30,000	30,000	.00176	.00010	.00030	.00016		
31,000	31,000	.00188	.00012	0 012	.....		
32,000	32,000	.00200	.00010	.....	.....		
33,000	33,000	.00210	.00010	.....	.....		
34,000	34,000	.00224	.00014	.....	.....		
35,000	35,000	.00246	.00022	.00074	.00044		
36,000	36,000	.00264	.00018	.....	.....		
37,000	37,000	.00280	.00016	.....	.....		
38,000	38,000	.00316	.00036	.....	.....		
39,000	39,000	.00342	.00026	.....	.....		
40,000	40,000	.00364	.00022	.00164	.00090		
41,000	41,000	.00416	.00052	.....	.....		
42,000	42,000	.00440	.00024	.....	.....		
43,000	43,000	.00502	.00062	.....	.....		
44,000	44,000	.00548	.00046	.....	.....		
45,000	45,000	.00600	.00052	.00370	.00206		
46,000	46,000	.00658	.00058	.....	.....		
47,000	47,000	.00690	.00032	.....	.....		
48,000	48,000	.00760	.00070	.....	.....		
49,000	49,000	.00822	.00062	.....	.....		
50,000	50,000	.00922	.00100	.00654	.00284		
60,820	60,820						Ultimate strength.

Failed by triple flexure.

BODY No. 24.

No. 4697.

Marks, <sup>12 M R A T B</sup><sub>B T</sub>

Diameter, 1".129.

Sectional area, 1 square inch.

Length of stem, 23".

Gauged length, 20".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.000055	.000055	.....	.....	
3,000	3,000	.000105	.000105	.....	.....	
4,000	4,000	.000160	.000160	.....	.....	
5,000	5,000	.000215	.000215	0.	.....	
6,000	6,000	.000270	.000270	.....	.....	
7,000	7,000	.000340	.000340	.....	.....	
8,000	8,000	.000400	.000400	.....	.....	
9,000	9,000	.000455	.000455	.....	.....	
10,000	10,000	.000520	.000520	.000035	.000035	
11,000	11,000	.000580	.000580	.000070	.....	
12,000	12,000	.000655	.000655	.000050	.000015	
13,000	13,000	.000725	.000700	.....	.....	
14,000	14,000	.000800	.000675	.000090	.000040	
15,000	15,000	.000890	.000690	.....	.....	
16,000	16,000	.000980	.000690	.000140	.000050	
17,000	17,000	.001070	.000690	.....	.....	
18,000	18,000	.001195	.000725	.000205	.000065	
19,000	19,000	.001300	.000765	.....	.....	
20,000	20,000	.001430	.000810	.000320	.000115	
21,000	21,000	.001585	.000865	.....	.....	
22,000	22,000	.001775	.000940	.000520	.000200	
23,000	23,000	.002000	.000925	.....	.....	
24,000	24,000	.002295	.000945	.000805	.000345	
25,000	25,000	.002650	.000955	.001155	.000290	
27,160	27,160	.....	.....	.....	.....	

Fractured 10".5 from neck. Appearance, granular.

No. 4698.

Marks, <sup>12 M R, T R,</sup>  
<sub>M T,</sub>  
 Diameter, 1<sup>1</sup>/<sub>129</sub>.  
 Sectional area, 1 square inch.  
 Length of stem, 23".  
 Gauged length, 20".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0.	0.	0.		
2,000	2,000	.000050	.000050	.....	.....		
3,000	3,000	.000100	.000050	.....	.....		
4,000	4,000	.000150	.000050	.....	.....		
5,000	5,000	.000200	.000050	0.	.....		
6,000	6,000	.000250	.000050	.....	.....		
7,000	7,000	.000300	.000050	.....	.....		
8,000	8,000	.000355	.000055	.....	.....		
9,000	9,000	.000405	.000050	.....	.....		
10,000	10,000	.000470	.000065	.000010	.000010		
11,000	11,000	.000535	.000065	.....	.....		
12,000	12,000	.000590	.000055	.000035	.000025		
13,000	13,000	.000655	.000065	.....	.....		
14,000	14,000	.000710	.000055	.000050	.000015		
15,000	15,000	.000780	.000070	.....	.....		
16,000	16,000	.000850	.000070	.000065	.000015		
17,000	17,000	.000920	.000070	.....	.....		
18,000	18,000	.001000	.000080	.000120	.000055		
19,000	19,000	.001075	.000075	.....	.....		
20,000	20,000	.001160	.000085	.000155	.000035		
21,000	21,000	.001260	.000100	.....	.....		
22,000	22,000	.001375	.000115	.000250	.000095		
23,000	23,000	.001600	.000225	.....	.....		
24,000	24,000	.001800	.000200	.000550	.000300		
25,000	25,000	.001900	.000100	.000655	.000105		
28,560	28,560	.....	.....	.....	.....		Tensile strength.

Fractured at neck. Appearance, granular.

No. 1066.

Marks,  $12 M R_1 T R_2$ Length, 10'' $\frac{5}{8}$ .Diameter, 1'' $\frac{129}{16}$ .

Sectional area, 1 square inch.

Gauged length, 5''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.00004	.00034	.....	.....	
3,000	3,000	.00010	.00006	.....	.....	
4,000	4,000	.00014	.00004	.....	.....	
5,000	5,000	.00020	.00006	.00002	.00002	
6,000	6,000	.00026	.00006	.....	.....	
7,000	7,000	.00032	.00006	.....	.....	
8,000	8,000	.00038	.00006	.....	.....	
9,000	9,000	.00044	.00006	.....	.....	
10,000	10,000	.00050	.00006	.00004	.00002	
11,000	11,000	.00056	.00006	.....	.....	
12,000	12,000	.00062	.00006	.....	.....	
13,000	13,000	.00068	.00006	.....	.....	
14,000	14,000	.00074	.00006	.....	.....	
15,000	15,000	.00080	.00006	.00003	.00004	
16,000	16,000	.00088	.00008	.....	.....	
17,000	17,000	.00094	.00006	.....	.....	
18,000	18,000	.00100	.00006	.....	.....	
19,000	19,000	.00106	.00006	.....	.....	
20,000	20,000	.00112	.00006	.00018	.00010	
21,000	21,000	.00120	.00008	.....	.....	
22,000	22,000	.00128	.00008	.....	.....	
23,000	23,000	.00132	.00004	.....	.....	
24,000	24,000	.00144	.00012	.....	.....	
25,000	25,000	.00154	.00010	.00036	.00018	
26,000	26,000	.00164	.00010	.....	.....	
27,000	27,000	.00176	.00012	.....	.....	
28,000	28,000	.00192	.00016	.....	.....	
29,000	29,000	.00208	.00016	.....	.....	
30,000	30,000	.00226	.00018	.00078	.00042	
31,000	31,000	.00246	.00020	.....	.....	
32,000	32,000	.00266	.00020	.....	.....	
33,000	33,000	.00292	.00026	.....	.....	
34,000	34,000	.00326	.00034	.....	.....	
35,000	35,000	.00372	.00046	.00196	.00118	
36,000	36,000	.00410	.00038	.....	.....	
37,000	37,000	.00440	.00030	.....	.....	
38,000	38,000	.00490	.00050	.....	.....	
39,000	39,000	.00546	.00056	.....	.....	
40,000	40,000	.00598	.00052	.00352	.00196	
41,000	41,000	.00642	.00044	.....	.....	
42,000	42,000	.00692	.00050	.....	.....	
43,000	43,000	.00748	.00056	.....	.....	
44,000	44,000	.00810	.00062	.....	.....	
45,000	45,000	.00882	.00072	.00642	.00250	
46,000	46,000	.00930	.00048	.....	.....	
47,000	47,000	.00994	.00064	.....	.....	
48,000	48,000	.01074	.00080	.....	.....	
49,000	49,000	.01160	.00086	.....	.....	
50,000	50,000	.01240	.00080	.00968	.00326	
60,040	60,040	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

No. 1067.

Marks, <sup>12 M R<sub>14</sub> T B<sub>2</sub></sup>  
<sub>B R<sub>10</sub></sub>  
 Length, 10'' .5.  
 Diameter, 1'' .129.  
 Sectional area, 1 square inch.  
 Gauged length, 5''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.00004	.00004	.....	.....	
3,000	3,000	.00008	.00004	.....	.....	
4,000	4,000	.00012	.00004	.....	.....	
5,000	5,000	.00018	.00006	0.	.....	
6,000	6,000	.00024	.00006	.....	.....	
7,000	7,000	.00030	.00006	.....	.....	
8,000	8,000	.00036	.00006	.....	.....	
9,000	9,000	.00042	.00006	.....	.....	
10,000	10,000	.00048	.00006	.00002	.00002	
11,000	11,000	.00052	.00004	.....	.....	
12,000	12,000	.00058	.00006	.....	.....	
13,000	13,000	.00064	.00006	.....	.....	
14,000	14,000	.00070	.00006	.....	.....	
15,000	15,000	.00076	.00006	.00008	.00006	
16,000	16,000	.00082	.00006	.....	.....	
17,000	17,000	.00088	.00006	.....	.....	
18,000	18,000	.00094	.00006	.....	.....	
19,000	19,000	.00100	.00006	.....	.....	
20,000	20,000	.00108	.00008	.00012	.00004	
21,000	21,000	.00116	.00008	.....	.....	
22,000	22,000	.00122	.00006	.....	.....	
23,000	23,000	.00130	.00008	.....	.....	
24,000	24,000	.00138	.00006	.....	.....	
25,000	25,000	.00144	.00008	.00024	.00012	
26,000	26,000	.00156	.00012	.....	.....	
27,000	27,000	.00168	.00012	.....	.....	
28,000	28,000	.00178	.00010	.....	.....	
29,000	29,000	.00192	.00014	.....	.....	
30,000	30,000	.00210	.00018	.00064	.00040	
31,000	31,000	.00234	.00024	.....	.....	
32,000	32,000	.00254	.00020	.....	.....	
33,000	33,000	.00286	.00032	.....	.....	
34,000	34,000	.00318	.00032	.....	.....	
35,000	35,000	.00350	.00032	.00176	.00112	
36,000	36,000	.00390	.00040	.....	.....	
37,000	37,000	.00432	.00042	.....	.....	
38,000	38,000	.00470	.00038	.....	.....	
39,000	39,000	.00522	.00052	.....	.....	
40,000	40,000	.00580	.00058	.00380	.00204	
41,000	41,000	.00634	.00054	.....	.....	
42,000	42,000	.00674	.00040	.....	.....	
43,000	43,000	.00724	.00050	.....	.....	
44,000	44,000	.00776	.00052	.....	.....	
45,000	45,000	.00812	.00036	.00582	.00202	
46,000	46,000	.00852	.00040	.....	.....	
47,000	47,000	.00902	.00050	.....	.....	
48,000	48,000	.00930	.00028	.....	.....	
49,000	49,000	.00950	.00020	.....	.....	
50,000	50,000	.00958	.00008	.00720	.00138	
50,200	50,200	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

No. 1063.

Marks, <sup>12 M R, T B,</sup>  
<sub>M N,</sub>  
 Length, 10'' .5.  
 Diameter, 1'' .129.  
 Sectional area, 1 square inch.  
 Gauged length, 5''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0.	0.	0.		
2,000	2,000	.00004	.00004				
3,000	3,000	.00008	.00004				
4,000	4,000	.00014	.00006				
5,000	5,000	.00018	.00004	0.			
6,000	6,000	.00024	.00006				
7,000	7,000	.00030	.00006				
8,000	8,000	.00036	.00006				
9,000	9,000	.00042	.00006				
10,000	10,000	.00048	.00006	.00002	.00002		
11,000	11,000	.00056	.00008				
12,000	12,000	.00062	.00006				
13,000	13,000	.00068	.00006				
14,000	14,000	.00074	.00006				
15,000	15,000	.00080	.00006	.00010	.00008		
16,000	16,000	.00088	.00008				
17,000	17,000	.00094	.00006				
18,000	18,000	.00100	.00006				
19,000	19,000	.00106	.00006				
20,000	20,000	.00112	.00006	.00016	.00006		
21,000	21,000	.00120	.00008				
22,000	22,000	.00128	.00008				
23,000	23,000	.00134	.00006				
24,000	24,000	.00140	.00006				
25,000	25,000	.00150	.00010	.00028	.00012		
26,000	26,000	.00160	.00010				
27,000	27,000	.00170	.00010				
28,000	28,000	.00180	.00010				
29,000	29,000	.00182	.00012				
30,000	30,000	.00210	.00018	.00002	.00034		
31,000	31,000	.00232	.00022				
32,000	32,000	.00250	.00018				
33,000	33,000	.00276	.00026				
34,000	34,000	.00310	.00034				
35,000	35,000	.00344	.00034	.00170	.00108		
36,000	36,000	.00382	.00038				
37,000	37,000	.00412	.00030				
38,000	38,000	.00454	.00042				
39,000	39,000	.00502	.00048				
40,000	40,000	.00562	.00060	.00360	.00190		
41,000	41,000	.00596	.00034				
42,000	42,000	.00652	.00056				
43,000	43,000	.00700	.00048				
44,000	44,000	.00780	.00060				
45,000	45,000	.00802	.00042	.00572	.00212		
46,000	46,000	.00846	.00044				
47,000	47,000	.00880	.00034				
48,000	48,000	.00914	.00034				
49,000	49,000	.00930	.00016				
50,000	50,000	.00940	.00010	.00098	.00126		
50,900	50,900						Ultimate strength.

Failed by triple flexure.

BODY No. 25.

No. 4709.

Marks, <sup>12 M R T R</sup><sub>B T</sub> .  
 Diameter, 1".129.  
 Sectional area, 1 square inch.  
 Length of stem, 23".  
 Gauged length, 20".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.000055	.000055			
3,000	3,000	.000110	.000055			
4,000	4,000	.000160	.000050			
5,000	5,000	.000225	.000065	.000005	.000005	
6,000	6,000	.000285	.000060			
7,000	7,000	.000345	.000060			
8,000	8,000	.000400	.000055			
9,000	9,000	.000455	.000055			
10,000	10,000	.000525	.000070	.000030	.000025	
11,000	11,000	.000590	.000065			
12,000	12,000	.000655	.000065	.000055	.000025	
13,000	13,000	.000730	.000075			
14,000	14,000	.000810	.000070	.000085	.000030	
15,000	15,000	.000895	.000085			
16,000	16,000	.000990	.000095	.000140	.000055	
17,000	17,000	.001090	.000100			
18,000	18,000	.001200	.000110	.000200	.000060	
19,000	19,000	.001300	.000100			
20,000	20,000	.001430	.000130	.000300	.000100	
21,000	21,000	.001500	.000170			
22,000	22,000	.001775	.000175	.000500	.000200	
23,000	23,000	.001995	.000220			
24,000	24,000	.002250	.000255	.000810	.000310	
25,000	25,000	.002600	.000350	.001000	.000250	
27,130	27,130					

Fractured 10".9 from neck. Appearance, granular.

No. 4710.

Marks, 11' M R<sub>2</sub> T R<sub>1</sub>  
 M T<sub>1</sub>  
 Diameter, 1.7129.  
 Sectional area, 1 square inch.  
 Length of stem, 23'.  
 Gauged length, 20'.

Applied loads..		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.000050	.000050			
3,000	3,000	.000100	.000050			
4,000	4,000	.000150	.000050			
5,000	5,000	.000200	.000050	0.		
6,000	6,000	.000250	.000050			
7,000	7,000	.000300	.000050			
8,000	8,000	.000350	.000050			
9,000	9,000	.000405	.000055			
10,000	10,000	.000455	.000050	.00010	.000010	
11,000	11,000	.000510	.000055			
12,000	12,000	.000560	.000050	.000030	.000020	
13,000	13,000	.000625	.000065			
14,000	14,000	.000685	.000070	.000045	.000015	
15,000	15,000	.000750	.000055			
16,000	16,000	.000810	.000060	.000055	.000010	
17,000	17,000	.000880	.000080			
18,000	18,000	.000960	.000070	.000095	.000040	
19,000	19,000	.001040	.000080			
20,000	20,000	.001120	.000080	.000145	.000050	
21,000	21,000	.001225	.000105			
22,000	22,000	.001320	.000095	.000205	.000060	
23,000	23,000	.001450	.000130			
24,000	24,000	.001555	.000105	.000325	.000120	
24,720	24,720					Tensile strength.

Fractured 11" from neck. Appearance, granular; coarse spangles.



No. 1070.

Marks, <sup>12 M R<sub>1</sub> T R<sub>2</sub></sup>  
<sub>B T<sub>1</sub></sub>

Length, 10'.5.

Diameter, 1".129.

Sectional area, 1 square inch.

Gauged length, 5'.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.00004	.00004			
3,000	3,000	.00008	.00004			
4,000	4,000	.00014	.00006			
5,000	5,000	.00020	.00006	0.		
6,000	6,000	.00028	.00008			
7,000	7,000	.00034	.00006			
8,000	8,000	.00038	.00004			
9,000	9,000	.00046	.00008			
10,000	10,000	.00052	.00006	.00002	.00002	
11,000	11,000	.00060	.00008			
12,000	12,000	.00066	.00006			
13,000	13,000	.00070	.00004			
14,000	14,000	.00076	.00006			
15,000	15,000	.00082	.00006	.00006	.00004	
16,000	16,000	.00088	.00006			
17,000	17,000	.00094	.00006			
18,000	18,000	.00100	.00006			
19,000	19,000	.00106	.00066			
20,000	20,000	.00112	.00306	.00012	.00006	
21,000	21,000	.00120	.00008			
22,000	22,000	.00130	.00010			
23,000	23,000	.00138	.00008			
24,000	24,000	.00144	.00306			
25,000	25,000	.00152	.00008	.00026	.00014	
26,000	26,000	.00162	.00010			
27,000	27,000	.00174	.00012			
28,000	28,000	.00184	.00010			
29,000	29,000	.00196	.00012			
30,000	30,000	.00212	.00016	.00060	.00034	
31,000	31,000	.00232	.00020			
32,000	32,000	.00250	.00018			
33,000	33,000	.00274	.00024			
34,000	34,000	.00300	.00026			
35,000	35,000	.00338	.00038	.00156	.00096	
36,000	36,000	.00370	.00032			
37,000	37,000	.00398	.00028			
38,000	38,000	.00442	.00044			
39,000	39,000	.00500	.00058			
40,000	40,000	.00558	.00058	.00348	.00192	
41,000	41,000	.00602	.00044			
42,000	42,000	.00646	.00044			
43,000	43,000	.00700	.00054			
44,000	44,000	.00756	.00056			
45,000	45,000	.00836	.00080	.00592	.00244	
46,000	46,000	.00878	.00042			
47,000	47,000	.00930	.00052			
48,000	48,000	.01012	.00082			
49,000	49,000	.01078	.00060			
50,000	50,000	.01210	.00132	.00996	.00344	
58,040	58,040					Ultimate strength.

Failed by triple flexure.

H. Ex. 43—19

No. 1071.

Marks,  $12 M R_{10} T R_4$   
 $B R_{10}$   
 Length, 10".5.  
 Diameter, 1".129.  
 Sectional area, 1 square inch.  
 Gauged length, 5".

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00002	.00002			
3,000	3,000	.00010	.00008			
4,000	4,000	.00016	.00006			
5,000	5,000	.00022	.00006	.00002	.00002	
6,000	6,000	.00028	.00006			
7,000	7,000	.00034	.00006			
8,000	8,000	.00040	.00006			
9,000	9,000	.00048	.00008			
10,000	10,000	.00054	.00006	.00006	.00004	
11,000	11,000	.00060	.00006			
12,000	12,000	.00068	.00008			
13,000	13,000	.00074	.00006			
14,000	14,000	.00080	.00006			
15,000	15,000	.00084	.00004	.00010	.00004	
16,000	16,000	.00090	.00006			
17,000	17,000	.00096	.00006			
18,000	18,000	.00102	.00006			
19,000	19,000	.00108	.00006			
20,000	20,000	.00116	.00008	.00016	.00006	
21,000	21,000	.00122	.00006			
22,000	22,000	.00130	.00008			
23,000	23,000	.00138	.00008			
24,000	24,000	.00146	.00008			
25,000	25,000	.00154	.00008	.00030	.00014	
26,000	26,000	.00166	.00012			
27,000	27,000	.00176	.00010			
28,000	28,000	.00188	.00012			
29,000	29,000	.00202	.00014			
30,000	30,000	.00220	.00018	.00068	.00038	
31,000	31,000	.00238	.00018			
32,000	32,000	.00254	.00016			
33,000	33,000	.00280	.00026			
34,000	34,000	.00312	.00032			
35,000	35,000	.00350	.00038	.00170	.00102	
36,000	36,000	.00392	.00042			
37,000	37,000	.00422	.00030			
38,000	38,000	.00470	.00048			
39,000	39,000	.00528	.00058			
40,000	40,000	.00580	.00052	.00374	.00204	
41,000	41,000	.00628	.00048			
42,000	42,000	.00682	.00054			
43,000	43,000	.00740	.00058			
44,000	44,000	.00828	.00088			
45,000	45,000	.00872	.00044	.00630	.00256	
46,000	46,000	.00944	.00072			
47,000	47,000	.01000	.00056			
48,000	48,000	.01058	.00058			
49,000	49,000	.01178	.00120			
50,000	50,000	.01308	.00130	.01022	.00392	
52,300	52,300					Ultimate strength.

Failed by triple flexure.

No. 1072.

Marks, <sup>12 M R, T B,</sup>  
<sup>M T,</sup>  
 Length, 10'' .5.  
 Diameter, 1'' .129.  
 Sectional area, 1 square inch.  
 Gauged length, 5''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.00004	.00004			
3,000	3,000	.00008	.00004			
4,000	4,000	.00012	.00004			
5,000	5,000	.00018	.00006	0.		
6,000	6,000	.00024	.00006			
7,000	7,000	.00030	.00006			
8,000	8,000	.00036	.00006			
9,000	9,000	.00042	.00006			
10,000	10,000	.00048	.00006	.00002	.00002	
11,000	11,000	.00054	.00006			
12,000	12,000	.00060	.00006			
13,000	13,000	.00066	.00006			
14,000	14,000	.00072	.00006			
15,000	15,000	.00078	.00006	.00004	.00002	
16,000	16,000	.00082	.00004			
17,000	17,000	.00088	.00006			
18,000	18,000	.00094	.00006			
19,000	19,000	.00100	.00006			
20,000	20,000	.00106	.00006	.00010	.00006	
21,000	21,000	.00112	.00006			
22,000	22,000	.00120	.00008			
23,000	23,000	.00126	.00008			
24,000	24,000	.00132	.00006			
25,000	25,000	.00140	.00008	.00018	.00008	
26,000	26,000	.00148	.00008			
27,000	27,000	.00154	.00006			
28,000	28,000	.00162	.00008			
29,000	29,000	.00174	.00012			
30,000	30,000	.00186	.00012	.00040	.00022	
31,000	31,000	.00196	.00010			
32,000	32,000	.00208	.00012			
33,000	33,000	.00222	.00014			
34,000	34,000	.00240	.00018			
35,000	35,000	.00266	.00026	.00092	.00052	
36,000	36,000	.00290	.00024			
37,000	37,000	.00310	.00020			
38,000	38,000	.00336	.00026			
39,000	39,000	.00380	.00044			
40,000	40,000	.00412	.00032	.00210	.00118	
41,000	41,000	.00448	.00036			
42,000	42,000	.00486	.00038			
43,000	43,000	.00520	.00034			
44,000	44,000	.00562	.00042			
45,000	45,000	.00610	.00048	.00384	.00174	
46,000	46,000	.00654	.00044			
47,000	47,000	.00688	.00034			
48,000	48,000	.00710	.00022			
49,000	49,000	.00722	.00012			
50,000	50,000	.00736	.00014	.00496	.00112	
59,700	59,700					Ultimate strength.

Failed by triple flexure.

BODY No. 26.

No. 4719.

Marks, <sup>12 M R, T B,</sup>  
B T<sub>1</sub>

Diameter, 1".129.

Sectional area, 1 square inch.

Length of stem, 23".

Gauged length, 20".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.000050	.000050	.....	.....	
3,000	3,000	.000100	.000050	.....	.....	
4,000	4,000	.000150	.000050	.....	.....	
5,000	5,000	.000200	.000050	0.	.....	
6,000	6,000	.000255	.000055	.....	.....	
7,000	7,000	.000305	.000050	.....	.....	
8,000	8,000	.000360	.000055	.....	.....	
9,000	9,000	.000410	.000050	.....	.....	
10,000	10,000	.000470	.000060	.000015	.000015	
11,000	11,000	.000540	.000070	.....	.....	
12,000	12,000	.000600	.000080	.000045	.000030	
13,000	13,000	.000660	.000060	.....	.....	
14,000	14,000	.000740	.000080	.000060	.000015	
15,000	15,000	.000800	.000060	.....	.....	
16,000	16,000	.000865	.000065	.000090	.000030	
17,000	17,000	.000950	.000085	.....	.....	
18,000	18,000	.001050	.000100	.000150	.000060	
19,000	19,000	.001155	.000105	.....	.....	
20,000	20,000	.001260	.000105	.000240	.000090	
21,000	21,000	.001365	.000135	.....	.....	
22,000	22,000	.001520	.000125	.000350	.000110	
23,000	23,000	.001700	.000180	.....	.....	
24,000	24,000	.001895	.000195	.000585	.000235	
25,000	25,000	.002100	.000265	.000770	.000185	
28,870	28,870	.....	.....	.....	.....	

Fractured, 3".6 from neck. Appearance, granular.

No. 4720.

Marks, 12M R, TR,  
M T,

Diameter, 1".129.

Sectional area, 1 square inch.

Length of stem, 23".

Gauged length, 20".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.000050	.000050			
3,000	3,000	.000095	.000045			
4,000	4,000	.000145	.000050			
5,000	5,000	.000195	.000050	.000005	.000005	
6,000	6,000	.000245	.000050			
7,000	7,000	.000295	.000050			
8,000	8,000	.000350	.000055			
9,000	9,000	.000400	.000050			
10,000	10,000	.000450	.000050	.000015	.000010	
11,000	11,000	.000500	.000050			
12,000	12,000	.000550	.000050	.000030	.000015	
13,000	13,000	.000615	.000055			
14,000	14,000	.000680	.000065	.000045	.000015	
15,000	15,000	.000740	.000060			
16,000	16,000	.000800	.000060	.000055	.000010	
17,000	17,000	.000875	.000075			
18,000	18,000	.000940	.000065	.000095	.000040	
19,000	19,000	.001010	.000070			
20,000	20,000	.001085	.000085	.000120	.000025	
21,000	21,000	.001195	.000100			
22,000	22,000	.001290	.000095	.000200	.000080	
23,000	23,000	.001400	.000110			
24,000	24,000	.001520	.000120	.000305	.000105	
25,000	25,000	.001700	.000180	.000410	.000105	
26,310	26,310					

Fractured 10".3 from neck. Appearance, granular.

No. 1076.

Marks, <sup>12 M R, T R,</sup>  
<sup>B 7 1/2</sup>  
 Length, 10<sup>1/2</sup>.  
 Diameter, 1<sup>1/2</sup>.129.  
 Sectional area, 1 square inch.  
 Gauged length, 5<sup>1/2</sup>.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0.	0.	0.		
2,000	2,000	.00006	.00006	.....	.....		
3,000	3,000	.00012	.00006	.....	.....		
4,000	4,000	.00016	.00004	.....	.....		
5,000	5,000	.00022	.00006	.00004	.00004		
6,000	6,000	.00026	.00004	.....	.....		
7,000	7,000	.00032	.00006	.....	.....		
8,000	8,000	.00038	.00006	.....	.....		
9,000	9,000	.00044	.00006	.....	.....		
10,000	10,000	.00048	.00004	.00006	.00002		
11,000	11,000	.00054	.00006	.....	.....		
12,000	12,000	.00058	.00004	.....	.....		
13,000	13,000	.00064	.00006	.....	.....		
14,000	14,000	.00070	.00006	.....	.....		
15,000	15,000	.00076	.00006	.00008	.00002		
16,000	16,000	.00082	.00006	.....	.....		
17,000	17,000	.00086	.00004	.....	.....		
18,000	18,000	.00092	.00006	.....	.....		
19,000	19,000	.00098	.00006	.....	.....		
20,000	20,000	.00104	.00006	.00012	.00004		
21,000	21,000	.00110	.00006	.....	.....		
22,000	22,000	.00116	.00006	.....	.....		
23,000	23,000	.00122	.00006	.....	.....		
24,000	24,000	.00130	.00008	.....	.....		
25,000	25,000	.00136	.00006	.00018	.00006		
26,000	26,000	.00144	.00008	.....	.....		
27,000	27,000	.00152	.00008	.....	.....		
28,000	28,000	.00160	.00008	.....	.....		
29,000	29,000	.00170	.00010	.....	.....		
30,000	30,000	.00180	.00010	.00038	.00020		
31,000	31,000	.00196	.00016	.....	.....		
32,000	32,000	.00208	.00012	.....	.....		
33,000	33,000	.00220	.00012	.....	.....		
34,000	34,000	.00236	.00016	.....	.....		
35,000	35,000	.00260	.00024	.00088	.00050		
36,000	36,000	.00284	.00024	.....	.....		
37,000	37,000	.00308	.00024	.....	.....		
38,000	38,000	.00340	.00032	.....	.....		
39,000	39,000	.00380	.00040	.....	.....		
40,000	40,000	.00424	.00044	.00224	.00136		
41,000	41,000	.00468	.00044	.....	.....		
42,000	42,000	.00506	.00038	.....	.....		
43,000	43,000	.00552	.00046	.....	.....		
44,000	44,000	.00608	.00056	.....	.....		
45,000	45,000	.00652	.00044	.00422	.00198		
46,000	46,000	.00700	.00048	.....	.....		
47,000	47,000	.00742	.00042	.....	.....		
48,000	48,000	.00806	.00064	.....	.....		
49,000	49,000	.00876	.00070	.....	.....		
50,000	50,000	.00934	.00058	.00672	.00250		
62,520	62,520	.....	.....	.....	.....		Ultimate strength.

Failed by triple flexure.

No. 1077.

Marks, <sup>12</sup>M R. T R.  
<sup>B R.</sup>

Length, 10' .5.

Diameter, 1" .129.

Sectional area, 1 square inch.

Gauged length, 5'.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.00004	.00004			
3,000	3,000	.00010	.00008			
4,000	4,000	.00014	.00004			
5,000	5,000	.00018	.00004	0.		
6,000	6,000	.00024	.00008			
7,000	7,000	.00030	.00008			
8,000	8,000	.00034	.00004			
9,000	9,000	.00038	.00004			
10,000	10,000	.00042	.00004	.00002	.00002	
11,000	11,000	.00048	.00008			
12,000	12,000	.00054	.00008			
13,000	13,000	.00060	.00008			
14,000	14,000	.00064	.00004			
15,000	15,000	.00070	.00008	.00004	.00002	
16,000	16,000	.00078	.00008			
17,000	17,000	.00082	.00004			
18,000	18,000	.00088	.00008			
19,000	19,000	.00094	.00008			
20,000	20,000	.00100	.00008	.00010	.00006	
21,000	21,000	.00106	.00008			
22,000	22,000	.00112	.00008			
23,000	23,000	.00118	.00008			
24,000	24,000	.00124	.00008			
25,000	25,000	.00134	.00010	.00020	.00010	
26,000	26,000	.00144	.00010			
27,000	27,000	.00154	.00010			
28,000	28,000	.00162	.00008			
29,000	29,000	.00174	.00012			
30,000	30,000	.00186	.00012	.00046	.00026	
31,000	31,000	.00200	.00014			
32,000	32,000	.00212	.00012			
33,000	33,000	.00232	.00020			
34,000	34,000	.00260	.00028			
35,000	35,000	.00288	.00028	.00122	.00076	
36,000	36,000	.00332	.00044			
37,000	37,000	.00366	.00034			
38,000	38,000	.00416	.00050			
39,000	39,000	.00462	.00046			
40,000	40,000	.00510	.00048	.00312	.00190	
41,000	41,000	.00558	.00048			
42,000	42,000	.00592	.00084			
43,000	43,000	.00660	.00078			
44,000	44,000	.00722	.00062			
45,000	45,000	.00786	.00064	.00580	.00248	
46,000	46,000	.00840	.00054			
47,000	47,000	.00882	.00042			
48,000	48,000	.00930	.00048			
49,000	49,000	.00986	.00066			
50,000	50,000	.01078	.00082	.00820	.00280	
62,580	62,580					Ultimate strength.

Failed by triple flexure.

No. 1078.

Marks, <sup>12 M R<sub>2</sub> T R<sub>1</sub></sup>  
<sub>M T<sub>3</sub></sub>  
 Length, 10''<sup>5</sup>/<sub>8</sub>.  
 Diameter, 1''<sup>129</sup>/<sub>32</sub>.  
 Sectional area, 1 square inch.  
 Gauged length, 5''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.00004	.00004			
3,000	3,000	.00008	.00004			
4,000	4,000	.00014	.00008			
5,000	5,000	.00018	.00004	0.		
6,000	6,000	.00024	.00008			
7,000	7,000	.00028	.00004			
8,000	8,000	.00034	.00008			
9,000	9,000	.00040	.00008			
10,000	10,000	.00044	.00004	.00002	.00002	
11,000	11,000	.00050	.00008			
12,000	12,000	.00054	.00004			
13,000	13,000	.00060	.00008			
14,000	14,000	.00066	.00008			
15,000	15,000	.00072	.00008	.00004	.00002	
16,000	16,000	.00076	.00004			
17,000	17,000	.00084	.00008			
18,000	18,000	.00090	.00008			
19,000	19,000	.00094	.00004			
20,000	20,000	.00102	.00008	.00012	.00008	
21,000	21,000	.00108	.00008			
22,000	22,000	.00114	.00008			
23,000	23,000	.00122	.00008			
24,000	24,000	.00128	.00006			
25,000	25,000	.00136	.00008	.00020	.00008	
26,000	26,000	.00144	.00008			
27,000	27,000	.00150	.00006			
28,000	28,000	.00160	.00010			
29,000	29,000	.00172	.00012			
30,000	30,000	.00182	.00010	.00042	.00022	
31,000	31,000	.00200	.00018			
32,000	32,000	.00212	.00012			
33,000	33,000	.00230	.00018			
34,000	34,000	.00250	.00020			
35,000	35,000	.00286	.00036	.00120	.00078	
36,000	36,000	.00306	.00020			
37,000	37,000	.00346	.00040			
38,000	38,000	.00382	.00036			
39,000	39,000	.00410	.00028			
40,000	40,000	.00494	.00074	.00238	.00168	
41,000	41,000	.00524	.00040			
42,000	42,000	.00556	.00032			
43,000	43,000	.00604	.00018			
44,000	44,000	.00652	.00048			
45,000	45,000	.00718	.00066	.00490	.00202	
46,000	46,000	.00768	.00050			
47,000	47,000	.00812	.00044			
48,000	48,000	.00854	.00042			
49,000	49,000	.00920	.00066			
50,000	50,000	.00966	.00046	.00718	.00228	
62,750	62,750					Ultimate strength.

Failed by triple flexure.



## BODY NO. 27.

No. 4739.

Marks, <sup>12 M R. T B,</sup>  
<sub>B T,</sub>

Diameter, 1".129.

Sectional area, 1 square inch.

Length of stem, 23".

Gauged length, 20".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.000055	.000055	.....	.....	
3,000	3,000	.000105	.000050	.....	.....	
4,000	4,000	.000155	.000050	.....	.....	
5,000	5,000	.000210	.000055	0.	.....	
6,000	6,000	.000265	.000055	.....	.....	
7,000	7,000	.000325	.000060	.....	.....	
8,000	8,000	.000375	.000050	.....	.....	
9,000	9,000	.000445	.000070	.....	.....	
10,000	10,000	.000500	.000055	.000020	.000020	
11,000	11,000	.000570	.000070	.....	.....	
12,000	12,000	.000640	.000070	.000050	.000030	
13,000	13,000	.000710	.000070	.....	.....	
14,000	14,000	.000790	.000080	.000085	.000035	
15,000	15,000	.000875	.000085	.....	.....	
16,000	16,000	.000945	.000070	.000110	.000025	
17,000	17,000	.001010	.000085	.....	.....	
18,000	18,000	.001085	.000085	.000130	.000020	
19,000	19,000	.001200	.000105	.....	.....	
20,000	20,000	.001330	.000130	.000240	.000110	
21,000	21,000	.001500	.000170	.....	.....	
22,000	22,000	.001685	.000185	.000440	.000200	
23,000	23,000	.001915	.000230	.....	.....	
24,000	24,000	.002125	.000210	.000785	.000345	
25,000	25,000	.002550	.000425	.001055	.000270	
25,940	25,940	.....	.....	.....	.....	Tensile strength.

Fractured 5".1 from neck. Appearance, granular.

No. 4740.

Marks, <sup>12 M P. T R.</sup>  
<sub>M T</sub>

Diameter, 1".129.

Sectional area, 1 square inch.

Length of stem, 23".

Gauged length, 20".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0.	0.	0.		
2,000	2,000	.000050	.000050	.....	.....		
3,000	3,000	.000100	.000050	.....	.....		
4,000	4,000	.000150	.000050	.....	.....		
5,000	5,000	.000200	.000050	0.	.....		
6,000	6,000	.000250	.000050	.....	.....		
7,000	7,000	.000300	.000050	.....	.....		
8,000	8,000	.000350	.000050	.....	.....		
9,000	9,000	.000400	.000050	.....	.....		
10,000	10,000	.000450	.000050	.000010	.000010		
11,000	11,000	.000500	.000050	.....	.....		
12,000	12,000	.000550	.000050	.000015	.000005		
13,000	13,000	.000610	.000060	.....	.....		
14,000	14,000	.000665	.000055	.000040	.000025		
15,000	15,000	.000730	.000065	.....	.....		
16,000	16,000	.000790	.000060	.000055	.000015		
17,000	17,000	.000850	.000060	.....	.....		
18,000	18,000	.000910	.000060	.000085	.000030		
19,000	19,000	.000990	.000080	.....	.....		
20,000	20,000	.001060	.000070	.000110	.000025		
21,000	21,000	.001155	.000095	.....	.....		
22,000	22,000	.001225	.000070	.000170	.000060		
23,000	23,000	.001325	.000100	.....	.....		
24,000	24,000	.001410	.000085	.000250	.000030		
25,000	25,000	.001550	.000140	.000315	.000065		
26,580	26,580	.....	.....	.....	.....		Tensile strength.

Fractured at the neck. Appearance, granular.

No. 1079.

Marks, <sup>12 M R, T R,</sup>  
<sub>B T,</sub>  
 Length, 10' .5.  
 Diameter, 1" .129.  
 Sectional area, 1 square inch.  
 Gaged length, 5'.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.00004	.00004	.....	.....	
3,000	3,000	.00010	.00006	.....	.....	
4,000	4,000	.00014	.00004	.....	.....	
5,000	5,000	.00018	.00004	.00004	.00004	
6,000	6,000	.00024	.00006	.....	.....	
7,000	7,000	.00028	.00004	.....	.....	
8,000	8,000	.00034	.00006	.....	.....	
9,000	9,000	.00038	.00004	.....	.....	
10,000	10,000	.00044	.00006	.00006	.00002	
11,000	11,000	.00050	.00006	.....	.....	
12,000	12,000	.00054	.00004	.....	.....	
13,000	13,000	.00060	.00006	.....	.....	
14,000	14,000	.00066	.00006	.....	.....	
15,000	15,000	.00072	.00006	.00008	.00002	
16,000	16,000	.00078	.00006	.....	.....	
17,000	17,000	.00082	.00004	.....	.....	
18,000	18,000	.00090	.00008	.....	.....	
19,000	19,000	.00096	.00006	.....	.....	
20,000	20,000	.00102	.00006	.00012	.00004	
21,000	21,000	.00110	.00008	.....	.....	
22,000	22,000	.00118	.00008	.....	.....	
23,000	23,000	.00124	.00006	.....	.....	
24,000	24,000	.00132	.00008	.....	.....	
25,000	25,000	.00140	.00006	.00024	.00012	
26,000	26,000	.00150	.00010	.....	.....	
27,000	27,000	.00160	.00010	.....	.....	
28,000	28,000	.00170	.00010	.....	.....	
29,000	29,000	.00180	.00010	.....	.....	
30,000	30,000	.00192	.00012	.00050	.00026	
31,000	31,000	.00212	.00020	.....	.....	
32,000	32,000	.00228	.00016	.....	.....	
33,000	33,000	.00246	.00018	.....	.....	
34,000	34,000	.00272	.00026	.....	.....	
35,000	35,000	.00306	.00034	.00136	.00086	
36,000	36,000	.00324	.00028	.....	.....	
37,000	37,000	.00366	.00032	.....	.....	
38,000	38,000	.00406	.00042	.....	.....	
39,000	39,000	.00448	.00040	.....	.....	
40,000	40,000	.00500	.00052	.00300	.00164	
41,000	41,000	.00552	.00052	.....	.....	
42,000	42,000	.00584	.00032	.....	.....	
43,000	43,000	.00646	.00062	.....	.....	
44,000	44,000	.00700	.00054	.....	.....	
45,000	45,000	.00780	.00080	.00546	.00246	
46,000	46,000	.00822	.00042	.....	.....	
47,000	47,000	.00870	.00046	.....	.....	
48,000	48,000	.00928	.00058	.....	.....	
49,000	49,000	.00982	.00054	.....	.....	
50,000	50,000	.01060	.00078	.00802	.00256	
50,100	50,100	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

No. 1080.

Marks, <sup>12 M R<sub>77</sub> T R<sub>2</sub></sup>  
<sub>B R<sub>10</sub></sub>

Length, 10'.5.

Diameter, 1".129.

Sectional area, 1 square inch.

Gauged length, 5".

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0.	0.	0.		
2,000	2,000	.00004	.00004	.....	.....		
3,000	3,000	.00008	.00004	.....	.....		
4,000	4,000	.00012	.00004	.....	.....		
5,000	5,000	.00018	.00006	0.	.....		
6,000	6,000	.00022	.00004	.....	.....		
7,000	7,000	.00026	.00004	.....	.....		
8,000	8,000	.00030	.00004	.....	.....		
9,000	9,000	.00036	.00006	.....	.....		
10,000	10,000	.00042	.00006	0.	.....		
11,000	11,000	.00048	.00006	.....	.....		
12,000	12,000	.00052	.00004	.....	.....		
13,000	13,000	.00058	.00006	.....	.....		
14,000	14,000	.00064	.00006	.....	.....		
15,000	15,000	.00070	.00006	.00002	.00002		
16,000	16,000	.00076	.00006	.....	.....		
17,000	17,000	.00080	.00004	.....	.....		
18,000	18,000	.00088	.00008	.....	.....		
19,000	19,000	.00094	.00006	.....	.....		
20,000	20,000	.00100	.00006	.00010	.00008		
21,000	21,000	.00106	.00006	.....	.....		
22,000	22,000	.00112	.00006	.....	.....		
23,000	23,000	.00120	.00008	.....	.....		
24,000	24,000	.00130	.00010	.....	.....		
25,000	25,000	.00138	.00308	.00020	.00010		
26,000	26,000	.00146	.00008	.....	.....		
27,000	27,000	.00160	.00014	.....	.....		
28,000	28,000	.00172	.00012	.....	.....		
29,000	29,000	.00178	.00006	.....	.....		
30,000	30,000	.00188	.00010	.00048	.00028		
31,000	31,000	.00204	.00016	.....	.....		
32,000	32,000	.00220	.00016	.....	.....		
33,000	33,000	.00240	.00020	.....	.....		
34,000	34,000	.00260	.00020	.....	.....		
35,000	35,000	.00300	.00040	.00132	.00084		
36,000	36,000	.00332	.00032	.....	.....		
37,000	37,000	.00362	.00030	.....	.....		
38,000	38,000	.00402	.00040	.....	.....		
39,000	39,000	.00442	.00040	.....	.....		
40,000	40,000	.00502	.00060	.00306	.00174		
41,000	41,000	.00552	.00050	.....	.....		
42,000	42,000	.00592	.00040	.....	.....		
43,000	43,000	.00648	.00056	.....	.....		
44,000	44,000	.00692	.00044	.....	.....		
45,000	45,000	.00730	.00038	.00508	.00202		
46,000	46,000	.00784	.00054	.....	.....		
47,000	47,000	.00830	.00046	.....	.....		
48,000	48,000	.00860	.00030	.....	.....		
49,000	49,000	.00886	.00026	.....	.....		
50,000	50,000	.00902	.00016	.00666	.00158		
58,980	58,980	.....	.....	.....	.....		Ultimate strength.

Failed by triple flexure.

No. 108L

Marks, <sup>12</sup>M R, <sup>T</sup>B,  
<sub>M 7<sub>3</sub></sub>

Length, 10''<sup>5</sup>/<sub>16</sub>.

Diameter, 1''<sup>129</sup>/<sub>16</sub>.

Sectional area, 1 square inch.

Gauged length, 5''.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.00004	.00004	.....	.....	
3,000	3,000	.00010	.00008	.....	.....	
4,000	4,000	.00014	.00004	.....	.....	
5,000	5,000	.00018	.00004	.00002	.00002	
6,000	6,000	.00022	.00004	.....	.....	
7,000	7,000	.00028	.00006	.....	.....	
8,000	8,000	.00032	.00004	.....	.....	
9,000	9,000	.00038	.00006	.....	.....	
10,000	10,000	.00044	.00006	.00002	0.	
11,000	11,000	.00048	.00004	.....	.....	
12,000	12,000	.00054	.00006	.....	.....	
13,000	13,000	.00058	.00004	.....	.....	
14,000	14,000	.00064	.00006	.....	.....	
15,000	15,000	.00072	.00008	.00004	.00002	
16,000	16,000	.00078	.00004	.....	.....	
17,000	17,000	.00082	.00006	.....	.....	
18,000	18,000	.00088	.00004	.....	.....	
19,000	19,000	.00094	.00008	.....	.....	
20,000	20,000	.00100	.00006	.00008	.00004	
21,000	21,000	.00106	.00006	.....	.....	
22,000	22,000	.00114	.00008	.....	.....	
23,000	23,000	.00118	.00004	.....	.....	
24,000	24,000	.00122	.00004	.....	.....	
25,000	25,000	.00130	.00008	.00012	.00004	
26,000	26,000	.00140	.00010	.....	.....	
27,000	27,000	.00148	.00008	.....	.....	
28,000	28,000	.00154	.00006	.....	.....	
29,000	29,000	.00168	.00012	.....	.....	
30,000	30,000	.00178	.00012	.00034	.00022	
31,000	31,000	.00192	.00014	.....	.....	
32,000	32,000	.00208	.00016	.....	.....	
33,000	33,000	.00222	.00014	.....	.....	
34,000	34,000	.00250	.00028	.....	.....	
35,000	35,000	.00278	.00028	.00108	.00074	
36,000	36,000	.00300	.00022	.....	.....	
37,000	37,000	.00328	.00028	.....	.....	
38,000	38,000	.00368	.00040	.....	.....	
39,000	39,000	.00428	.00060	.....	.....	
40,000	40,000	.00488	.00060	.00288	.00180	
41,000	41,000	.00538	.00050	.....	.....	
42,000	42,000	.00570	.00032	.....	.....	
43,000	43,000	.00652	.00082	.....	.....	
44,000	44,000	.00730	.00078	.....	.....	
45,000	45,000	.00810	.00080	.00572	.00284	
46,000	46,000	.00910	.00100	.....	.....	
47,000	47,000	.00978	.00068	.....	.....	
48,000	48,000	.01060	.00082	.....	.....	
49,000	49,000	.01170	.00110	.....	.....	
50,000	50,000	.01300	.00130	.01008	.00436	
50,460	50,460	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

## 12-INCH B. L. RIFLED MORTARS.

*Chemical composition of cast-iron bodies.*

Tension test number.	No. of body.	Mark on specimen.	Carbon.			Manganese.	Silicon.	Sulphur.	Phosphorus.	Copper.
			Total.	Graphitic.	Combined.					
4549	1	B T <sub>1</sub> .....	2.371	2.036	0.335	0.619	0.868	0.055	0.315	0.009
4550	1	M T <sub>1</sub> .....	2.822	2.206	0.616	0.581	0.875	0.051	0.298	0.017
4555	2	B T <sub>1</sub> .....	3.285	2.187	1.148	0.554	0.933	0.061	0.296	0.013
4556	2	M T <sub>1</sub> .....	3.581	2.102	1.479	0.510	0.980	0.070	0.358	0.015
4527	2	B T <sub>1</sub> .....	2.321	1.949	0.372	0.445	0.850	0.066	0.395	0.010
4528	2	M T <sub>1</sub> .....	2.358	2.066	0.292	0.450	0.850	0.070	0.415	0.012
4559	3	B T <sub>1</sub> .....	3.492	2.390	1.112	0.583	1.174	0.066	0.366	0.012
4560	3	M T <sub>1</sub> .....	3.615	2.060	1.615	0.613	1.064	0.060	0.365	0.010
4529	4	B T <sub>1</sub> .....	2.285	2.032	0.253	0.480	0.850	0.075	0.502	0.018
4530	4	M T <sub>1</sub> .....	2.672	2.305	0.367	0.470	0.850	0.070	0.426	0.016
4531	5	B T <sub>1</sub> .....	2.195	1.783	0.412	0.387	0.700	0.081	0.408	0.012
4532	5	M T <sub>1</sub> .....	2.492	1.739	0.753	0.374	0.650	0.082	0.374	0.015
4573	6	B T <sub>1</sub> .....	2.727	2.165	0.562	0.422	0.700	0.070	0.375	0.012
4574	6	M T <sub>1</sub> .....	2.713	1.857	0.856	0.355	0.650	0.088	0.365	0.015
4575	7	B T <sub>1</sub> .....	2.322	1.930	0.392	0.310	0.700	0.064	0.382	0.010
4576	7	M T <sub>1</sub> .....	2.337	1.963	0.374	0.585	0.700	0.094	0.374	0.010
4578	8	B T <sub>1</sub> .....	2.672	2.187	0.535	0.450	0.700	0.092	0.382	0.008
4579	8	M T <sub>1</sub> .....	2.506	2.230	0.278	0.445	0.750	0.080	0.368	0.009
4580	9	B T <sub>1</sub> .....	2.454	2.116	0.338	0.501	0.690	0.081	0.522	0.010
4581	9	M T <sub>1</sub> .....	2.454	2.353	0.101	0.520	0.690	0.078	0.389	0.009
4584	10	B T <sub>1</sub> .....	2.356	2.181	0.175	0.482	0.653	0.085	0.395	0.009
4585	10	M T <sub>1</sub> .....	2.606	2.045	0.561	0.472	0.655	0.080	0.591	0.012
4594	10	B T <sub>1</sub> .....	2.834	2.131	0.703	0.483	0.700	0.079	0.374	0.008
4595	10	M T <sub>1</sub> .....	2.874	2.216	0.658	0.512	0.650	0.085	0.381	0.005
4618	10	B T <sub>1</sub> .....	2.585	1.854	0.731	0.385	0.800	0.065	0.415	0.008
4619	10	M T <sub>1</sub> .....	2.339	1.827	0.512	0.387	0.750	0.055	0.396	0.007
100	10	M T <sub>24</sub> M O ..	2.091	1.816	0.275	0.400	0.840	0.058	0.302	0.006
4586	11	B T <sub>1</sub> .....	2.821	2.157	0.664	0.542	0.653	0.084	0.350	0.009
4587	11	M T <sub>1</sub> .....	2.806	2.052	0.754	0.540	0.671	0.082	0.365	0.008
4600	12	B T <sub>1</sub> .....	2.394	2.056	0.338	0.470	0.700	0.063	0.439	0.008
4601	12	M T <sub>1</sub> .....	2.884	2.001	0.883	0.465	0.700	0.075	0.378	0.006
4626	12	B T <sub>1</sub> .....	2.577	2.127	0.450	0.305	0.770	0.045	0.463	0.005
4627	12	M T <sub>1</sub> .....	2.577	2.102	0.475	0.315	0.750	0.047	0.420	0.006
110	12	M T <sub>24</sub> M O ..	2.124	1.434	0.690	0.301	0.800	0.041	0.515	0.005
4596	13	B T <sub>1</sub> .....	2.777	2.007	0.770	0.450	0.560	0.070	0.295	0.006
4597	13	M T <sub>1</sub> .....	3.070	1.750	1.320	0.431	0.806	0.061	0.289	0.008
4660	13	B T <sub>1</sub> .....	2.781	2.080	0.701	0.361	0.765	0.055	0.400	0.006
4670	13	{ Extra disk. }	2.331	1.576	0.755	0.368	0.667	0.065	0.414	0.005
4661	13	M T <sub>1</sub> .....	2.282	1.805	0.477	0.374	0.770	0.045	0.402	0.004
4598	14	B T <sub>1</sub> .....	2.383	1.989	0.394	0.490	0.800	0.072	0.469	0.006
4599	14	M T <sub>1</sub> .....	2.383	2.203	0.180	0.512	0.750	0.072	0.603	0.006
4666	14	B T <sub>1</sub> .....	2.727	1.967	0.860	0.426	0.850	0.063	0.364	0.008
4667	14	M T <sub>1</sub> .....	2.601	1.862	0.739	0.413	0.780	0.060	0.356	0.004
4604	15	B T <sub>1</sub> .....	2.841	1.884	0.957	0.460	0.975	0.072	0.405	0.005
4605	15	M T <sub>1</sub> .....	2.301	1.895	0.406	0.620	0.387	0.067	0.408	0.006
59	15	M T <sub>1</sub> M O ..	2.181	1.802	0.379	0.462	0.960	0.060	0.354	0.006
4668	15	B T <sub>1</sub> .....	2.727	2.080	0.647	0.437	0.800	0.064	0.730	0.005
4669	15	M T <sub>1</sub> .....	2.781	2.086	0.695	0.420	0.850	0.066	0.748	0.005
4606	16	B T <sub>1</sub> .....	2.899	1.826	0.573	0.481	0.933	0.078	0.445	0.006
4607	16	M T <sub>1</sub> .....	2.861	1.805	0.556	0.480	0.935	0.072	0.415	0.008
4671	16	B T <sub>1</sub> .....	2.836	1.791	1.045	0.497	1.165	0.046	0.436	0.004
4672	16	M T <sub>1</sub> .....	2.855	2.017	0.838	0.503	1.081	0.045	0.367	0.004
4610	17	B T <sub>1</sub> .....	2.606	1.992	0.614	0.467	0.700	0.068	0.378	0.005
4611	17	M T <sub>1</sub> .....	2.808	1.857	0.951	0.475	0.700	0.080	0.362	0.005
4612	18	B T <sub>1</sub> .....	2.721	2.181	0.540	0.457	0.870	0.059	0.390	0.006
4613	18	M T <sub>1</sub> .....	2.367	2.088	0.279	0.450	0.770	0.058	0.349	0.004

## 12-INCH B. L. RIFLED MORTARS.

*Chemical composition of cast-iron bodies—Continued.*

Tension test number.	No. of body.	Mark on specimen.	Carbon.			Manganese.	Silicon.	Sulphur.	Phosphorus.	Copper.
			Total.	Graphitic.	Combined.					
4877	19	B T <sub>1</sub> .....	2.252	1.903	0.349	0.432	0.882	0.050	0.380	0.010
4878	19	M T <sub>1</sub> .....	2.298	1.919	0.349	0.428	0.884	0.040	0.369	0.008
4681	20	B T <sub>1</sub> .....	2.275	1.919	0.356	0.437	1.004	0.044	0.460	0.011
4682	20	M T <sub>1</sub> .....	2.222	1.786	0.436	0.440	0.846	0.046	0.368	0.012
4715	20	B T <sub>11</sub> .....	2.366	1.914	0.452	0.348	0.874	0.075	0.407	0.010
4716	20	M T <sub>11</sub> .....	2.473	1.892	0.581	0.374	0.658	0.070	0.391	0.010
4683	21	B T <sub>1</sub> .....	2.424	1.936	0.488	0.445	0.620	0.060	0.403	0.006
4684	21	M T <sub>1</sub> .....	2.637	1.966	0.671	0.441	0.800	0.068	0.411	0.008
4699	21	M T <sub>1</sub> ..... Extra disk.	2.979	2.277	0.702	0.445	0.808	0.070	0.370	0.009
4749	21	B T <sub>11</sub> .....	2.863	1.783	1.080	0.379	0.940	0.070	0.361	0.009
4750	21	M T <sub>11</sub> .....	2.890	1.827	1.063	0.384	0.911	0.065	0.359	0.010
4688	22	B T <sub>1</sub> .....	2.536	1.941	0.595	0.501	0.800	0.078	0.433	0.011
4689	22	M T <sub>1</sub> .....	2.549	1.952	0.597	0.497	0.800	0.078	0.411	0.008
4753	22	B T <sub>11</sub> .....	2.241	1.827	0.414	0.413	0.864	0.059	0.425	0.015
4754	22	M T <sub>11</sub> .....	2.328	1.791	0.537	0.411	0.977	0.057	0.421	0.012
4693	23	B T <sub>1</sub> .....	2.470	1.960	0.510	0.432	0.882	0.066	0.384	0.012
4694	23	M T <sub>1</sub> .....	2.425	1.941	0.484	0.489	0.892	0.064	0.391	0.010
4755	23	B T <sub>11</sub> .....	2.140	1.810	0.330	0.348	0.900	0.063	0.381	0.010
4756	23	M T <sub>11</sub> .....	2.217	1.750	0.460	0.433	0.800	0.076	0.371	0.015
4697	24	B T <sub>1</sub> .....	2.759	2.086	0.673	0.438	0.836	0.065	0.385	0.010
4698	24	M T <sub>1</sub> .....	2.590	1.851	0.739	0.420	0.864	0.070	0.378	0.012
4709	25	B T <sub>1</sub> .....	2.173	1.718	0.455	0.400	0.846	0.066	0.365	0.006
4710	25	M T <sub>1</sub> .....	2.197	1.728	0.469	0.432	0.827	0.067	0.360	0.010
244	25	M T <sub>4</sub> M O ..	2.146	1.712	0.434	0.348	0.940	0.074	0.359	0.009
4719	26	B T <sub>1</sub> .....	2.606	1.914	0.692	0.342	0.864	0.066	0.342	0.009
4720	26	M T <sub>1</sub> .....	2.636	1.936	0.700	0.335	0.817	0.068	0.368	0.012
4739	27	B T <sub>1</sub> .....	2.273	1.718	0.555	0.396	0.977	0.070	0.367	0.015
4740	27	M T <sub>1</sub> .....	2.347	1.689	0.458	0.400	0.958	0.076	0.360	0.012

## 12-INCH B. L. RIFLED MORTARS.

## TABULATION OF TENSION SPECIMENS FROM CAST-IRON BODIES.

No. of test.	Number of—		Position in body.	Location of specimen.	Length of stem.	Sectional area.	Tensile strength per square inch.	Fracture.	Specific gravity.	Hardness.	Remarks.
	Mor- tar.	Spec- imen.									
4527	2	11	Breach	Inside	Inches. 23	1.00	Pounds. 25,000	Uniform granular.			
4528	2	11	Muzzle	do	23	1.00	30,780	do	7.3117		
4564	2	13	Breach	do	Grooved	1.00	28,060	do	15.28		
4565	2	14	do	Outside	do	1.00	32,380	do	17.35		
4566	2	15	do	do	do	1.00	32,240	do	7.3142		
4567	2	16	do	Inside	do	1.00	28,890	do	7.3113		
4568	2	17	do	do	do	1.00	20,890	do			
4569	2	18	do	Outside	do	1.00	30,010	do			
4570	2	19	do	do	do	1.00	30,300	do			
4571	2	13	Muzzle	Inside	do	1.00	32,100	do	7.3102	17.17	
4572	2	14	do	Outside	do	1.00	30,280	do	7.3102	15.28	
4573	2	15	do	do	do	1.00	32,970	do	7.3064	16.48	
4529	4	1	Breach	Inside	23	1.00	24,930	do			
4530	4	1	Muzzle	do	23	1.00	26,410	do			
6001	4	3	Breach	do	Grooved	1.00	29,010	do			
6002	4	4	do	Outside	do	1.00	30,890	do	7.3206	16.73	
6003	4	5	do	do	do	1.00	30,960	do	7.3320	16.07	
6004	4	6	do	Inside	do	1.00	31,430	do	7.3200	16.15	
6005	4	7	do	do	do	1.00	29,420	do			
6006	4	8	do	Outside	do	1.00	30,410	do			
6007	4	9	do	do	do	1.00	31,940	do			
6008	4	0	Muzzle	Inside	do	1.00	29,810	do	7.2979	15.28	
6009	4	4	do	Outside	do	1.00	31,770	do	7.3298	16.56	
6010	4	5	do	do	do	1.00	32,150	do	7.3021	15.59	
4531	5	1	Breach	Inside	23	1.00	25,000	Granular, mottled.			
4532	5	1	Muzzle	do	23	1.00	27,320	do			
6012	5	3	Breach	do	Grooved	1.00	29,150	do	7.3422	15.28	
6013	5	4	do	Outside	do	1.00	30,240	do	7.3473	15.99	
6014	5	5	do	do	do	1.00	32,720	do	7.3443	15.83	
6015	5	6	do	Inside	do	1.00	28,690	do			
6016	5	7	do	do	do	1.00	28,850	do			
6017	5	8	do	do	do	1.00	30,010	do			
6018	5	9	do	Outside	do	1.00	30,510	do			
6019	5	0	Muzzle	Inside	do	1.00	33,380	do	7.3409	17.62	
6020	5	4	do	Outside	do	1.00	29,290	do	7.3466	17.99	
6021	5	5	do	do	do	1.00	33,010	do	7.3341	15.83	

Second casting.



4578	1	Breech	Inside	23	1.00	25,500	Uniform granular	7,3278	15.43
4574	2	Muzzle	do	23	1.00	24,390	do		
6052	3	Breech	Grooved		1.00	29,510	do	7,3274	15.43
6028	4	do	do		1.00	30,470	do	7,3274	15.43
6024	5	do	do		1.00	31,980	do	7,3226	15.36
6025	6	do	do		1.00	30,450	do		
6026	7	do	do		1.00	29,600	do		
6027	8	do	do		1.00	30,600	do		
6028	9	do	do		1.00	31,350	do		
6029	3	Muzzle	do		1.00	30,130	do	7,3290	14.06
6030	4	do	do		1.00	30,780	do	7,3321	14.61
6031	5	do	do		1.00	30,670	do	7,3127	14.06
4575	7	Breech	Inside	23	1.00	30,590	Medium fine granular		
4576	8	Muzzle	do	23	1.00	27,640	Granular moist		
6036	9	Breech	Grooved		1.00	34,020	Medium fine granular	7,3240	15.47
6037	3	do	do		1.00	32,690	do	7,3274	15.90
6038	7	do	do		1.00	31,650	do	7,3141	16.31
6039	5	do	do		1.00	34,180	do		
6040	7	do	do		1.00	34,890	do	7,3468	16.73
6041	8	do	do		1.00	33,460	do		
6042	7	do	do		1.00	32,030	do		
6043	9	Muzzle	do		1.00	29,490	do	7,3167	15.13
6044	3	do	do		1.00	28,990	do	7,3219	15.28
6044	4	do	do		1.00	29,350	do	7,3045	14.98
6045	7	do	do		1.00	30,350	do		
4578	8	Breech	Inside	23	1.00	28,040	Uniform granular		
4579	1	Muzzle	do	23	1.00	25,690	do		
6047	2	Breech	Grooved		1.00	30,040	do	7,3149	15.13
6048	3	do	do		1.00	31,150	do	7,3115	14.91
6049	4	do	do		1.00	30,980	do	7,3051	14.83
6050	5	do	do		1.00	30,200	do		
6051	6	do	do		1.00	30,550	do		
6052	8	do	do		1.00	31,400	do		
6053	9	do	do		1.00	31,200	do		
6054	3	Muzzle	do		1.00	28,270	do	7,3008	14.91
6055	4	do	do		1.00	28,790	do	7,3230	15.67
6056	5	do	do		1.00	31,100	do	7,2934	14.83
4580	9	Breech	Inside	23	1.00	28,030	do		
4581	1	Muzzle	do	23	1.00	26,980	do		
6057	2	Breech	Grooved		1.00	29,570	do	7,3219	15.91
6058	3	do	do		1.00	28,700	do	7,3228	14.98
6059	4	do	do		1.00	32,020	do	7,3204	15.20
6060	5	do	do		1.00	30,450	do		
6061	6	do	do		1.00	29,030	do		
6062	7	do	do		1.00	28,820	do		
6063	9	do	do		1.00	30,040	do		
6064	3	Muzzle	do		1.00	28,150	do	7,2968	14.90
6065	4	do	do		1.00	34,430	Uniform fine granular	7,3322	15.83
6066	5	do	do		1.00	27,710	Uniform granular	7,2965	13.08

12-INCH B. L. RIFLED MORTARS.

TABULATION OF TENSION SPECIMENS FROM CAST-IRON BODIES.

No. of test.	Number of—		Position in body.	Location of specimen.	Length of stem.	Sectional area.	Tensile strength per square inch.	Fracture.	Specific gravity.	Hardness.	Remarks.
	Mor. tar.	Specimen.									
4527	2	11	Breech	Inside	Inches. 23	Sq. inch. 1.00	Pounds. 25,000	Uniform granular			
4528	2	11	Muzzle	do	23	1.00	30,780	do			
4564	2	13	Breech	do	Grooved	1.00	28,060	do	7.3117	15.28	
4565	2	14	do	Outside	do	1.00	32,380	do	7.3142	17.35	
4566	2	15	do	do	do	1.00	32,240	do	7.3113	15.20	
4567	2	16	do	Inside	do	1.00	28,890	do			
4568	2	17	do	do	do	1.00	29,880	do			
4569	2	18	do	Outside	do	1.00	30,010	do			
4570	2	19	do	do	do	1.00	30,300	do			
4571	2	13	Muzzle	Inside	do	1.00	32,160	do	7.3102	17.17	
4572	2	14	do	Outside	do	1.00	30,280	do	7.3102	15.28	
4573	2	15	do	do	do	1.00	32,970	do	7.3064	16.48	
4529	4	1	Breech	Inside	23	1.00	24,930	do			
4530	4	1	Muzzle	do	23	1.00	26,410	do			
6001	4	3	Breech	do	Grooved	1.00	29,010	do	7.3306	16.73	
6002	4	4	do	Outside	do	1.00	30,890	do	7.3320	16.07	
6003	4	5	do	do	do	1.00	30,960	do	7.3260	16.15	
6004	4	6	do	Inside	do	1.00	31,430	do			
6005	4	7	do	do	do	1.00	29,420	do			
6006	4	8	do	Outside	do	1.00	30,410	do			
6007	4	9	do	do	do	1.00	31,900	do			
6008	4	3	Muzzle	Inside	do	1.00	29,810	do	7.2979	15.28	
6009	4	4	do	Outside	do	1.00	31,770	do	7.3298	16.56	
6010	4	5	do	do	do	1.00	32,150	do	7.3021	15.59	
4531	5	1	Breech	Inside	23	1.00	25,000	Granular, mottled			
4532	5	1	Muzzle	do	23	1.00	27,320	do			
6012	5	3	Breech	do	Grooved	1.00	29,150	do	7.3423	15.28	
6013	5	4	do	Outside	do	1.00	30,200	do	7.3473	15.99	
6014	5	5	do	do	do	1.00	32,720	do	7.3445	15.83	
6015	5	6	do	Inside	do	1.00	29,690	do			
6016	5	7	do	do	do	1.00	28,950	do			
6017	5	8	do	Outside	do	1.00	30,010	do			
6018	5	9	do	do	do	1.00	29,510	do			
6019	5	3	Muzzle	Inside	do	1.00	33,390	do	7.3409	17.62	
6020	5	4	do	Outside	do	1.00	29,890	do	7.3469	17.99	
6021	5	5	do	do	do	1.00	33,010	do	7.3341	15.89	

Second casting.

4573	6	1	Breech	Inside	23	1.00	25,590	Uniform granular	7,3576	18.43
4574	6	1	Muzzle	do	23	1.00	28,990	do	7,3576	18.43
8023	6	2	Breech	Grooved		1.00	29,510	do	7,3574	15.99
8024	6	4	do	Outside	do	1.00	30,470	do	7,3226	15.99
8025	6	5	do	do	do	1.00	31,980	do		
8026	6	6	do	Inside	do	1.00	30,450	do		
8027	6	7	do	do	do	1.00	29,890	do		
8028	6	8	do	Outside	do	1.00	30,800	do		
8029	6	9	do	do	do	1.00	31,350	do		
8030	6	3	Muzzle	Inside	do	1.00	30,130	do	7,3299	14.09
8031	6	4	do	Outside	do	1.00	30,780	do	7,3321	14.61
8031	6	5	do	do	do	1.00	30,570	do	7,3127	14.09
4575	7	1	Breech	Inside	23	1.00	30,590	Medium fine granular		
4576	7	1	Muzzle	do	23	1.00	27,640	Granular notifiel		
8036	7	3	Breech	Grooved		1.00	34,020	Medium fine granular	7,3240	16.47
8037	7	4	do	Outside	do	1.00	32,990	do	7,3374	15.99
8038	7	5	do	do	do	1.00	31,950	do	7,3141	16.31
8039	7	6	do	Inside	do	1.00	34,180	do		
8040	7	7	do	do	do	1.00	33,980	do	7,3468	16.73
8041	7	8	do	Outside	do	1.00	33,450	do		
8042	7	8	do	do	do	1.00	32,030	do		
8043	7	3	Muzzle	Inside	do	1.00	29,490	do	7,3167	15.13
8044	7	4	do	Outside	do	1.00	28,990	do	7,3219	15.28
8045	7	5	do	do	do	1.00	30,350	do	7,3048	14.98
4578	8	1	Breech	Inside	23	1.00	28,040	Uniform granular		
4579	8	1	Muzzle	do	23	1.00	25,890	do		
8047	8	3	Breech	Grooved		1.00	30,040	do	7,3149	15.13
8048	8	4	do	Outside	do	1.00	31,150	do	7,3115	14.91
8049	8	5	do	do	do	1.00	30,980	do	7,3051	14.83
8050	8	6	do	Inside	do	1.00	30,200	do		
8051	8	7	do	do	do	1.00	30,550	do		
8052	8	8	do	Outside	do	1.00	31,490	do		
8053	8	9	do	do	do	1.00	31,420	do		
8054	8	3	Muzzle	Inside	do	1.00	29,270	do	7,3008	14.91
8055	8	4	do	Outside	do	1.00	30,790	do	7,3239	15.67
8056	8	5	do	do	do	1.00	31,100	do	7,3234	14.83
4580	9	1	Breech	Inside	23	1.00	28,030	do		
4581	9	1	Muzzle	do	23	1.00	26,960	do		
8057	9	3	Breech	Grooved		1.00	29,870	do	7,3219	15.91
8058	9	4	do	Outside	do	1.00	28,790	do	7,3228	14.98
8059	9	5	do	do	do	1.00	32,020	do	7,3204	15.20
8060	9	6	do	Inside	do	1.00	30,450	do		
8061	9	7	do	do	do	1.00	29,030	do		
8062	9	8	do	Outside	do	1.00	29,920	do		
8063	9	9	do	do	do	1.00	30,040	do		
8064	9	3	Muzzle	Inside	do	1.00	28,150	do	7,2968	14.90
8065	9	4	do	Outside	do	1.00	34,430	Uniform fine granular	7,3522	15.83
8066	9	5	do	do	do	1.00	27,710	Uniform granular	7,2465	13.08

TABULATION OF TENSION SPECIMENS FROM CAST-IRON BODIES—Continued.

No. of test.	Number of—		Position in body.	Location of specimen.	Length of stem.	Sectional area.	Tensile strength per square inch.	Fracture.	Specific gravity.	Hardness.	Remarks.
	Mor-	Speci-									
	tar.	men.				Sq. inch.	Pounds				
4584	10	1	Breech.	Inside	Inches 23	1.00	24,980	Uniform granular.			
4585	10	2	Muzzle	do	23	1.00	27,890	do.			
6087	10	3	Breech.	do	Grooved	1.00	28,410	do.	7.3189	14.19	
6088	10	4	do	Outside	do	1.00	28,320	do.	7.3195	14.16	
6089	10	5	do	do	do	1.00	29,890	do.	7.3123	14.96	
6070	10	6	do	Inside	do	1.00	31,010	do.			
6071	10	7	do	do	do	1.00	28,020	do.			
6072	10	8	do	Outside	do	1.00	30,250	do.			
6073	10	9	do	do	do	1.00	30,020	do.			
6074	10	3	Muzzle	Inside	do	1.00	30,740	do.	7.3195	14.69	
6075	10	4	do	Outside	do	1.00	30,010	do.	7.3205	15.75	
6076	10	5	do	do	do	1.00	30,710	do.	7.3053	15.20	
4594	10	11	Breech.	do	23	1.00	25,000	40 per cent uniform granular, 60 per cent coarse granular, with dark spangles.			
4595	10	11	Muzzle	do	23	1.00	28,940	Granular mottled.			
11	10	13	Breech.	Inside	Grooved	1.00	34,520	Uniform granular.	7.3144	15.51	
12	10	14	do	Outside	do	1.00	28,020	do.	7.3336	15.75	
13	10	15	do	do	do	1.00	32,260	do.	7.3254	15.21	
14	10	16	do	Inside	do	1.00	23,960	Granular, with coarse dark spangles.			
15	10	17	do	do	do	1.00	29,850	Uniform granular.			
16	10	18	do	Outside	do	1.00	33,980	do.			
17	10	19	do	do	do	1.00	31,770	do.	7.3297	15.43	
18	10	13	Muzzle	Inside	do	1.00	31,340	do.	7.3346	15.91	
19	10	14	do	Outside	do	1.00	29,200	do.	7.3095	15.51	
20	10	15	do	do	do	1.00	29,650	do.			
4618	10	31	Breech.	do	23	1.00	29,910	Granular.			
4619	10	31	Muzzle	do	23	1.00	28,140	do.			
92	10	33	Breech.	Inside	Grooved	1.00	31,040	do.	7.3283	17.08	
93	10	34	do	Outside	do	1.00	30,750	do.	7.3301	16.73	
94	10	35	do	do	do	1.00	31,120	do.	7.3268	16.81	
95	10	36	do	Inside	do	1.00	30,870	do.			
96	10	37	do	do	do	1.00	30,200	do.			
97	10	38	do	Outside	do	1.00	31,610	do.			
98	10	39	do	do	do	1.00	32,620	do.			
99	10	33	Muzzle	Inside	do	1.00	33,870	do.	7.3266	15.91	
100	10	34	do	Outside	do	1.00	37,960	do.	7.3643	17.62	
101	10	35	do	do	do	1.00	30,850	do.	7.2964	16.81	
4596	11	1	Breech.	Inside	23	1.00	29,340	Uniform granular.			
4597	11	1	Muzzle	do	23	1.00	27,580	do.			

Second casting.

Fourth casting.



TABULATION OF TENSION SPECIMENS FROM CAST-IRON BODIES—Continued.

No. of test.	Number of— Mor- tar.	Spec- imen.	Position in body.	Location of specimen.	Length of stem.	Sectional area.	Tensile strength per square inch.	Fracture.	Specific gravity.	Hardness.	Remarks.	
112	13	13	Breech	Inside	Inches. Grooved	Sq. inch. 1.00	Pounds. 29,040	Granular	7.8356	17.08	} Second casting.	
113	13	14	do	Outside	do	1.00	29,030	do	7.8393	17.53		
114	13	15	do	do	do	1.00	31,390	do	7.8372	16.82		
115	13	16	do	Inside	do	1.00	29,770	do				
116	13	17	do	do	do	1.00	30,240	do				
117	13	18	do	Outside	do	1.00	29,540	do				
118	13	19	do	do	do	1.00	28,750	Granular, with coarse stellar structure.	7.2998	17.44		
119	13	13	Muzzle	Inside	do	1.00	28,100	Granular.	7.3192	18.38		
120	13	14	do	Outside	do	1.00	23,500	do	7.3578	19.81		
121	13	15	do	do	do	1.00	29,900	do	7.3323	17.99		
4670	13	11	Breech	Inside	Inches. 23 Grooved	1.00	28,100	do	7.8361	17.17		} Extra disk from second casting.
142	13	13	do	do	do	1.00	31,160	do	7.8359	16.81		
143	13	14	do	Outside	do	1.00	31,030	do	7.8395	17.62		
144	13	15	do	do	do	1.00	32,990	do				
145	13	16	do	Inside	do	1.00	34,210	do				
146	13	17	do	do	do	1.00	29,920	do				
147	13	18	do	Outside	do	1.00	30,010	do				
148	13	19	do	do	do	1.00	30,550	do				
4598	14	1	do	Inside	Inches. 23	1.00	28,160	Uniform granular				
4599	14	1	Muzzle	do	do	1.00	25,020	Granular				
31	14	3	Breech	do	Grooved	1.00	30,290	do	7.8151	14.90		
32	14	4	do	Outside	do	1.00	27,100	do	7.8157	13.99		
33	14	5	do	do	do	1.00	29,340	do	7.3105	14.28		
34	14	6	do	Inside	do	1.00	29,120	do				
35	14	7	do	do	do	1.00	29,010	do				
36	14	8	do	Outside	do	1.00	29,720	do				
37	14	9	do	do	do	1.00	30,400	do				
38	14	3	Muzzle	Inside	do	1.00	29,680	do	7.2991	13.27		
39	14	4	do	Outside	do	1.00	29,870	do	7.3139	13.59		
40	14	5	do	do	do	1.00	30,820	do	7.2949	13.20		
4098	14	11	Breech	Inside	Inches. 23	1.00	26,120	do			} Second casting.	
4667	14	11	Muzzle	do	do	1.00	29,100	do				
122	14	13	Breech	do	Grooved	1.00	30,720	do	7.3403	16.90		
123	14	13	do	Outside	do	1.00	29,990	do	7.8410	15.09		
124	14	14	do	do	do	1.00	32,410	do	7.3428	15.43		
125	14	15	do	Inside	do	1.00	31,890	do				
126	14	17	do	do	do	1.00	29,690	do				
127	14	18	do	Outside	do	1.00	28,910	do				

129	14	do	do	do	31,900	1.00	do	do	do	7,3096	16.07	Second casting.	
130	14	Muzzle	Inside	do	29,950	1.00	do	do	do	7,3288	16.64		
131	14	do	Outside	do	31,010	1.00	do	do	do	7,3275	16.07		
132	14	do	do	do	32,030	1.00	do	do	do	do	do		
4004	15	Breech	Inside	23	25,060	1.00	Granular, with coarse stellar arrangement.	do	do	7,3045	13.46	Second casting.	
4005	15	Muzzle	do	23	25,000	1.00	Uniform granular.	do	do	7,3111	13.98		
31	5	Breech	do	Grooved	27,710	1.00	do	do	do	7,3087	14.19		
32	15	do	Outside	do	30,960	1.00	do	do	do	do	do		
33	15	do	do	do	27,620	1.00	do	do	do	do	do		
34	15	do	Inside	do	29,100	1.00	do	do	do	do	do		
35	15	do	do	do	29,400	1.00	do	do	do	do	do		
56	15	do	Outside	do	29,710	1.00	do	do	do	do	do		
57	15	do	do	do	23,990	1.00	do	do	do	7,2844	13.99		
58	15	Muzzle	Inside	do	37,240	1.00	Fine granular, granitic appearance.	do	do	7,3408	15.51		
59	15	do	Outside	do	29,150	1.00	Granular	do	do	7,2802	11.98		
60	15	do	do	do	do	1.00	do	do	do	do	do		
4068	15	Breech	Inside	23	27,120	1.00	do	do	do	7,3396	16.65		Second casting.
4069	15	Muzzle	do	23	29,050	1.00	do	do	do	7,3411	16.56		
132	15	Breech	do	Grooved	29,820	1.00	do	do	do	7,3410	16.56		
133	15	do	Outside	do	31,980	1.00	do	do	do	do	do		
134	15	do	do	do	32,100	1.00	do	do	do	do	do		
135	15	do	Inside	do	31,650	1.00	do	do	do	do	do		
136	15	do	do	do	31,460	1.00	do	do	do	do	do		
137	15	do	Outside	do	30,900	1.00	do	do	do	do	do		
138	15	do	do	do	29,940	1.00	do	do	do	7,2976	16.31		
139	15	Muzzle	Inside	do	31,830	1.00	Granular, in part fine.	do	do	7,3471	16.99		
140	15	do	Outside	do	30,740	1.00	do	do	do	7,3045	15.99		
141	15	do	do	do	do	1.00	do	do	do	do	do		
4006	16	Breech	Inside	23	23,380	1.00	Uniform granular.	do	do	7,3369	14.54	Second casting.	
4007	16	Muzzle	do	23	29,710	1.00	do	do	do	7,3397	14.19		
61	16	Breech	do	Grooved	29,630	1.00	Granular	do	do	7,3347	14.76		
62	16	do	Outside	do	29,410	1.00	do	do	do	do	do		
63	16	do	do	do	30,470	1.00	do	do	do	do	do		
64	16	do	Inside	do	29,210	1.00	do	do	do	do	do		
65	16	do	do	do	27,880	1.00	do	do	do	do	do		
66	16	do	Outside	do	29,310	1.00	do	do	do	do	do		
67	16	do	do	do	28,260	1.00	do	do	do	do	do		
68	16	Muzzle	Inside	do	32,060	1.00	do	do	do	7,3555	14.54		
69	16	do	Outside	do	33,200	1.00	do	do	do	7,3497	15.99		
70	16	do	do	do	33,010	1.00	do	do	do	7,3122	14.47		
4671	16	Breech	Inside	23	26,780	1.00	do	do	do	7,3454	17.35		Second casting.
4672	16	Muzzle	do	23	27,040	1.00	do	do	do	7,3441	16.56		
149	16	Breech	do	Grooved	29,320	1.00	do	do	do	7,3393	16.82		
150	16	do	Outside	do	29,670	1.00	do	do	do	do	do		
151	16	do	do	do	30,200	1.00	do	do	do	do	do		
152	16	do	do	do	29,020	1.00	do	do	do	do	do		
153	16	do	Inside	do	30,410	1.00	do	do	do	do	do		
154	16	do	do	do	31,630	1.00	do	do	do	do	do		
154	16	do	Outside	do	do	1.00	do	do	do	do	do		

TABULATION OF TENSION SPECIMENS FROM CAST-IRON BODIES—Continued.

No. of test.	Number of—		Position in body.	Location of specimen.	Length of stem.	Sectional area.	Tensile strength per square inch.	Fracture.	Specific gravity.	Hardness.	Remarks.
	Mor. tar.	Specimen.									
155	16	19	Breech	Outside	Inches. Grooved	1.00	30,010	Granular	7.3332	17.35	Second casting.
156	16	13	Muzzle	Inside	do	1.00	31,820	do	7.3348	17.71	
157	16	14	do	Outside	do	1.00	38,820	Fine granular	7.3150	17.90	
158	16	15	do	do	do	1.00	29,360	Granular			
4610	17	1	Breech	Inside	23	1.00	26,820	do			
4611	17	1	Muzzle	do	23	1.00	28,890	do			
71	17	3	Breech	do	Grooved	1.00	29,040	do	7.3376	16.73	
72	17	4	do	Outside	do	1.00	30,610	do	7.3414	16.31	
73	17	5	do	do	do	1.00	32,590	do	7.3346	16.82	
74	17	6	do	Inside	do	1.00	28,330	do			
75	17	7	do	do	do	1.00	30,370	do			
76	17	8	do	Outside	do	1.00	30,710	do			
77	17	9	do	do	do	1.00	30,280	do			
78	17	3	Muzzle	Inside	do	1.00	28,420	do	7.3132	17.17	
79	17	4	do	Outside	do	1.00	35,790	Fine granular	7.3557	17.81	
80	17	5	do	do	do	1.00	30,530	Granular	7.3137	17.08	
4612	18	1	Breech	Inside	23	1.00	27,660	do			
4613	18	1	Muzzle	do	23	1.00	29,610	do			
81	18	3	Breech	do	Grooved	1.00	29,640	do	7.3362	16.39	
82	18	4	do	Outside	do	1.00	30,020	do	7.3393	16.90	
83	18	5	do	do	do	1.00	31,110	do	7.3331	16.81	
84	18	6	do	Inside	do	1.00	30,010	do			
85	18	7	do	do	do	1.00	28,820	do			
86	18	8	do	Outside	do	1.00	30,550	do			
87	18	9	do	do	do	1.00	30,970	do			
88	18	3	Muzzle	Inside	do	1.00	30,790	do	7.3242	16.90	
89	18	4	do	Outside	do	1.00	32,480	do	7.3386	17.90	
90	18	5	do	do	do	1.00	30,360	do	7.2829	16.47	
4677	19	1	Breech	Inside	23	1.00	26,610	do			
4678	19	1	Muzzle	do	23	1.00	26,610	do			
159	19	2	Breech	do	Grooved	1.00	29,800	do	7.3280	16.31	
160	19	2	do	Outside	do	1.00	30,600	do	7.3287	16.31	
161	19	6	do	do	do	1.00	31,160	do	7.3222	16.75	
162	19	6	do	Inside	do	1.00	32,620	do			
163	19	7	do	do	do	1.00	29,870	do			
164	19	8	do	do	do	1.00	31,050	do			
165	19	9	do	Outside	do	1.00	30,620	do			
166	19	9x	do	do	do	1.00	30,890	do			
167	19	9xx	do	do	do	1.00	31,960	do			



Second casting.

164	19	3	Muzzle	Inside	do.	1.00	29.400	do.	7.3007	15.51
166	19	4	do	Outside	do.	1.00	29.770	do.	7.3054	16.75
170	19	5	do	do	do.	1.00	31.710	do.	7.3280	16.48
4681	20	1	Breech	Inside	23	1.00	26.220	do.	do.	do.
4682	20	2	Breech	do	23	1.00	26.440	do.	do.	do.
171	20	3	Breech	do	Grooved	1.00	26.480	do.	7.3397	16.48
172	20	4	do	Outside	do.	1.00	28.120	do.	7.3429	16.73
173	20	5	do	do	do.	1.00	30.470	do.	7.3421	16.73
174	20	6	do	Inside	do.	1.00	28.720	do.	do.	do.
175	20	7	do	do	do.	1.00	29.170	do.	do.	do.
176	20	8	do	Outside	do.	1.00	29.100	do.	do.	do.
177	20	9	do	do	do.	1.00	29.720	do.	do.	do.
178	20	9xx	do	do	do.	1.00	29.350	do.	do.	do.
179	20	9xx	do	do	do.	1.00	29.120	do.	do.	do.
180	20	3	Muzzle	Inside	do.	1.00	31.030	do.	7.3435	17.08
181	20	4	do	Outside	do.	1.00	33.050	do.	7.3509	16.73
182	20	5	do	do	do.	1.00	30.320	do.	7.3221	15.83
4715	20	11	Breech	Inside	23	1.00	25.710	Granular	do.	do.
4716	20	11	Muzzle	do	23	1.00	24.320	do.	do.	do.
246	20	13	Breech	do	Grooved	1.00	24.820	do.	7.3586	15.29
247	20	14	do	Outside	do.	1.00	30.510	do.	7.3629	15.91
248	20	15	do	do	do.	1.00	31.200	do.	7.3636	16.31
249	20	16	do	Inside	do.	1.00	31.060	do.	do.	do.
250	20	17	do	do	do.	1.00	30.420	do.	do.	do.
251	20	18	do	Outside	do.	1.00	30.250	do.	do.	do.
253	20	19	do	do	do.	1.00	30.110	do.	do.	do.
253	20	19xx	do	do	do.	1.00	30.990	do.	do.	do.
254	20	20	do	do	do.	1.00	30.740	do.	do.	do.
255	20	13	Muzzle	Inside	do.	1.00	30.680	do.	7.3543	16.73
256	20	14	do	Outside	do.	1.00	35.570	do.	7.3793	17.17
257	20	15	do	do	do.	1.00	32.360	do.	7.3372	16.15
4683	21	1	Breech	Inside	23	1.00	28.640	do.	do.	do.
4684	21	1	Muzzle	do	23	1.00	29.140	do.	do.	do.
183	21	3	Breech	do	Grooved	1.00	30.020	do.	7.3526	15.07
184	21	4	do	Outside	do.	1.00	30.710	do.	7.3296	15.59
185	21	5	do	do	do.	1.00	30.770	do.	7.3540	15.59
186	21	6	do	Inside	do.	1.00	28.300	do.	do.	do.
187	21	7	do	do	do.	1.00	28.910	do.	do.	do.
188	21	8	do	Outside	do.	1.00	28.960	do.	do.	do.
189	21	9	do	do	do.	1.00	31.250	do.	do.	do.
190	21	9xx	do	do	do.	1.00	31.040	do.	do.	do.
191	21	9xx	do	do	do.	1.00	30.460	do.	do.	do.
192	21	3	Muzzle	Inside	do.	1.00	28.200	do.	7.3204	15.05
193	21	4	do	Outside	do.	1.00	27.120	do.	7.3216	15.67
194	21	5	do	do	do.	1.00	30.980	do.	7.3035	14.54
4699	21	1	do	Inside	23	1.00	27.870	do.	7.2961	13.14
251	21	3	do	do	Grooved	1.00	27.870	do.	7.3290	13.66
252	21	4	do	Outside	do.	1.00	30.300	do.	do.	do.
253	21	5	do	do	do.	1.00	28.020	do.	7.3091	13.08

Extra disk.

TABULATION OF TENSION SPECIMENS FROM CAST-IRON BODIES—Continued.

No. of test.	Number of—		Position in body.	Location of specimen.	Length of stem.	Sectional area.	Tensile strength per square inch.	Fracture.	Specific gravity.	Hardness.	Remarks.
	Mor. tar.	Speci- ment.									
4749	21	11	Breech	Inside	Inches. 23	1.00	Potenda.	Granular.			
4750	21	11	Muzzle	do	23	1.00	25,320	do			
282	21	13	Breech	do	Grooved	1.00	28,650	do	7.8404	17.44	
283	21	14	do	Outside	do	1.00	28,300	do	7.8470	16.82	
284	21	15	do	do	do	1.00	27,610	do	7.8531	17.17	
285	21	16	do	Inside	do	1.00	30,290	do			
286	21	17	do	do	do	1.00	29,550	do			
287	21	18	do	Outside	do	1.00	28,710	do			
288	21	19	do	do	do	1.00	28,020	do			
289	21	19x	do	do	do	1.00	29,570	do			
290	21	19x	do	do	do	1.00	28,510	do			
291	21	13	Muzzle	Inside	do	1.00	31,250	do	7.8283	16.73	
292	21	14	do	Outside	do	1.00	34,740	do	7.8687	17.62	
293	21	15	do	do	do	1.00	30,420	do	7.8473	17.26	
4688	22	1	Breech	Inside	23	1.00	27,690	do			
4689	22	3	Muzzle	do	23	1.00	28,720	do			
195	22	4	Breech	do	Grooved	1.00	28,520	do	7.8315	13.33	
197	22	5	do	Outside	do	1.00	30,300	do	7.8305	15.43	
198	22	6	do	do	do	1.00	31,740	do	7.8321	12.84	
199	22	7	do	Inside	do	1.00	31,160	do			
200	22	8	do	do	do	1.00	30,700	do			
201	22	9	do	Outside	do	1.00	28,510	do			
202	22	9x	do	do	do	1.00	30,450	do			
203	22	9x	do	do	do	1.00	29,430	do			
204	22	9	Muzzle	Inside	do	1.00	30,190	do			
205	22	4	do	Outside	do	1.00	29,410	do	7.8458	13.20	
206	22	5	do	do	do	1.00	31,900	do	7.8492	13.08	
							28,520	do	7.8150	12.60	
4753	22	11	Breech	Inside	23	1.00	24,000	Granular with coarse spangles			
4754	22	11	Muzzle	do	23	1.00	28,160	Granular.			
284	22	13	Breech	do	Grooved	1.00	30,680	do	7.8302	16.73	
285	22	14	do	Outside	do	1.00	30,960	do	7.8397	17.06	
286	22	15	do	do	do	1.00	31,670	do	7.8411	16.90	
287	22	16	do	Inside	do	1.00	31,590	do			
288	22	17	do	do	do	1.00	28,590	do			
289	22	18	do	Outside	do	1.00	30,010	do			
800	22	19	do	do	do	1.00	29,720	do			
801	22	19x	do	do	do	1.00	29,620	do			
802	22	19xx	do	do	do	1.00	31,170	do			

Second castings.

Second castings.

803	23	Muzzle	Inside	do	27,690	do	7,3154	14.90
818	13x	do	do	do	28,920	do	7,3109	15.08
804	23	do	Outside	do	32,920	do	7,3404	17.08
805	22	do	do	do	31,100	do	7,3285	16.78
4682	1	Breech	Inside	23	25,010	do		
4684	23	Muzzle	do	23	28,020	do		
207	3	Breech	do	Grooved	28,790	do	7,3381	13.72
208	23	do	Outside	do	28,350	do	7,3358	18.72
209	23	do	do	do	31,700	do	7,3411	13.92
210	6	do	Inside	do	30,040	do		
211	7	do	do	do	30,100	do		
212	23	do	Outside	do	28,480	do		
213	23	do	do	do	28,310	do		
214	23	do	do	do	30,020	do		
215	33	do	do	do	29,400	do		
216	23	Muzzle	Inside	do	29,810	do		
217	23	do	Outside	do	31,730	do	7,3224	13.40
218	23	do	do	do	30,800	do	7,3440	14.19
							7,3288	13.46
4756	23	Breech	Inside	23	28,420	do		
4756	23	Muzzle	do	23	28,890	do		
306	23	Breech	do	Grooved	29,220	do	7,3369	15.67
307	23	do	Outside	do	29,070	do	7,3417	15.51
308	23	do	do	do	33,100	do	7,3454	15.99
309	23	do	Inside	do	32,580	do		
310	23	do	do	do	29,150	do		
311	23	do	Outside	do	29,320	do		
312	23	do	do	do	30,610	do		
313	23	do	do	do	28,650	do		
314	23	do	do	do	29,980	do		
315	23	Muzzle	Inside	do	31,440	do		
316	23	do	Outside	do	34,100	do	7,3177	17.08
317	23	do	do	do	29,610	do	7,3498	16.47
							7,3118	15.75
4687	24	Breech	Inside	23	27,160	do		
4688	24	Muzzle	do	23	28,500	do		
219	24	Breech	do	Grooved	28,030	do	7,3358	13.99
220	24	do	Outside	do	27,990	do	7,3392	13.46
221	24	do	do	do	29,250	do	7,3447	14.28
222	24	do	Inside	do	28,920	do		
223	24	do	do	do	27,210	do		
224	24	do	Outside	do	28,180	do		
225	24	do	do	do	29,970	do		
226	24	do	do	do	28,390	do		
227	24	do	do	do	29,130	do		
228	24	Muzzle	Inside	do	30,850	do		
229	24	do	Outside	do	30,820	do	7,3324	14.26
230	24	do	do	do	27,020	do	7,3471	14.12
							7,3355	14.12
4709	25	Breech	Inside	23	27,130	do		
4710	25	Muzzle	do	23	24,720	do		
								Granular, coarse spangles.

TABULATION OF TENSION SPECIMENS FROM CAST-IRON BODIES—Continued.

No. of test.	Number of—		Position in body.	Location of specimen.	Length of stem.	Sectional area.	Tensile strength per square inch.	Fracture.	Specific gravity.	Hardness.	Remarks.
	Mor-	Speci-									
	tar.	men.									
224	25	3	Breech...	Inside	Inches. Grooved	Sq. inch. 1.00	Pounds. 23,050	Granular.	7.3248	14.33	
225	25	4	do	Outside.	do	1.00	30,300	do.	7.3404	13.53	
226	25	5	do	do	do	1.00	30,500	do.	7.3466	14.40	
227	25	6	do	Inside	do	1.00	31,610	do.			
228	25	7	do	do	do	1.00	30,320	do.			
229	25	8	do	Outside.	do	1.00	29,700	do.			
230	25	9	do	do	do	1.00	29,890	do.			
241	25	9x	do	do	do	1.00	30,050	do.			
242	25	9xx	Muzzle	do	do	1.00	30,380	do.			
243	25	3	do	Inside	do	1.00	29,520	do.	7.3248	14.47	
244	25	4	do	Outside.	do	1.00	39,960	Very fine granular.	7.3783	15.91	
245	25	5	do	do	do	1.00	33,100	Granular.	7.3348	14.69	
4719	26	1	Breech...	Inside	23	1.00	26,870	do.			
4720	26	1	Muzzle	do	23	1.00	26,310	do.			
258	26	3	Breech...	do	Grooved	1.00	28,240	do.	7.3546	16.07	
259	26	4	do	Outside.	do	1.00	29,150	do.	7.3586	16.07	
260	26	5	do	do	do	1.00	32,410	do.	7.3600	15.99,	
261	26	6	do	Inside	do	1.00	29,990	do.			
262	26	7	do	do	do	1.00	28,320	do.			
263	26	8	do	Outside.	do	1.00	30,500	do.			
264	26	9	do	do	do	1.00	29,010	do.			
265	26	9x	do	do	do	1.00	29,630	do.			
266	26	9xx	do	do	do	1.00	29,910	do.			
267	26	3	Muzzle	Inside	do	1.00	24,580	do.	7.3400	17.35	
268	26	4	do	Outside.	do	1.00	29,530	do.	7.3325	16.81	
269	26	5	do	do	do	1.00	29,820	do.	7.3348	17.08	
4739	27	1	Breech...	Inside	23	1.00	25,940	do.			
4740	27	1	Muzzle	do	23	1.00	24,580	do.			
270	27	3	Breech...	do	Grooved	1.00	28,610	do.	7.3424	16.73	
271	27	4	do	Outside.	do	1.00	29,770	do.	7.3387	16.47	
272	27	5	do	do	do	1.00	29,690	do.	7.3442	16.56	
273	27	6	do	Inside	do	1.00	27,390	do.			
274	27	7	do	do	do	1.00	28,130	do.			
275	27	8	do	Outside.	do	1.00	29,110	do.			
276	27	9	do	do	do	1.00	29,130	do.			
277	27	9x	do	do	do	1.00	28,580	do.			
278	27	9xx	do	do	do	1.00	30,910	do.			
279	27	3	Muzzle	Inside	do	1.00	32,310	do.	7.3447	17.35	
280	27	4	do	Outside.	do	1.00	33,370	do.	7.3563	17.99	
281	27	5	do	do	do	1.00	30,450	do.	7.3187	15.75	

12-INCH B. L. RIFLED MORTARS.  
 TABULATION OF COMPRESSION SPECIMENS FROM CAST-IRON BODIES.

No. of test.	Number of—		Position in body.	Location of specimen.	Total length.	Sectional area.	Ultimate strength per square inch.	Manner of failure.	Specific gravity.	Hardness.	Remarks.
	Mor-tar.	Speci-men.									
964	2	12	Breech.....	Inside.....	Inches. 10.5	Sq. inch. 1.00	Pounds. 59,290	Triple fluxure.....			
965	2	20	do.....	Radial.....	10.5	1.00	58,470	do.....			
966	2	13	Muzzle.....	Inside.....	10.5	1.00	60,870	do.....			
967	4	2	Breech.....	Inside.....	10.5	1.00	63,100	do.....			
968	4	10	do.....	Radial.....	10.5	1.00	60,100	do.....			
969	4	2	Muzzle.....	Inside.....	10.5	1.00	60,480	do.....			
970	5	2	Breech.....	Inside.....	10.5	1.00	63,200	do.....			
971	5	10	do.....	Radial.....	10	1.00	62,800	do.....			
972	5	2	Muzzle.....	Inside.....	10.5	1.00	65,900	do.....			
977	6	2	Breech.....	Inside.....	10.5	1.00	61,200	do.....			
978	6	10	do.....	Radial.....	10.5	1.00	60,200	do.....			
979	6	2	Muzzle.....	Inside.....	10.5	1.00	59,300	do.....			
980	7	2	Breech.....	Inside.....	10.5	1.00	61,800	do.....			
981	7	10	do.....	Radial.....	10.5	1.00	60,580	do.....			
982	7	2	Muzzle.....	Inside.....	10.5	1.00	55,910	do.....			
983	8	2	Breech.....	Inside.....	10.5	1.00	58,680	do.....			
984	8	10	do.....	Radial.....	10.5	1.00	58,750	do.....			
985	8	2	Muzzle.....	Inside.....	10.5	1.00	58,020	do.....			
986	9	2	Breech.....	Inside.....	10.5	1.00	59,500	do.....			
987	9	10	do.....	Radial.....	10.5	1.00	59,650	do.....			
988	9	2	Muzzle.....	Inside.....	10.5	1.00	57,200	do.....			
992	10	2	Breech.....	Inside.....	10.5	1.00	57,200	do.....			
993	10	10	do.....	Radial.....	10.5	1.00	58,980	do.....			
994	10	2	Muzzle.....	Inside.....	10.5	1.00	56,380	do.....			
1001	10	12	Breech.....	Inside.....	10.5	1.00	59,200	do.....			} Second casting.
1002	10	20	do.....	Radial.....	10.5	1.00	58,980	do.....			
1003	10	12	Muzzle.....	Inside.....	10.5	1.00	57,970	do.....			} Fourth casting.
1025	10	32	Breech.....	Inside.....	10.5	1.00	60,380	do.....			
1026	10	40	do.....	Radial.....	10.5	1.00	60,630	do.....			
1027	10	32	Muzzle.....	Inside.....	10.5	1.00	58,620	do.....			

TABULATION OF COMPRESSION SPECIMENS FROM CAST-IRON BODIES—Continued.

No. of test.	Number of— Mor- tar.	Speci- men.	Position in body.	Location of specimen.	Total length.	Sectional area.	Ultimate strength per square inch.	Manner of failure.	Specific gravity.	Hardness	Remarks.
995	11	2	Breech...	Inside	10.5	Sq. inch.	Pounds.	Triple flexure...			
996	11	10	do	Radial	10.5	1.00	60,020	do			
997	11	2	Muzzle	Inside	10.5	1.00	58,500	do			
1010	12	22	Breech...	Inside	10.5	1.00	59,060	do			} Third casting.
1011	12	30	do	Radial	10.5	1.00	58,200	do			
1012	12	22	Muzzle	Inside	10.5	1.00	58,500	do			
1028	12	32	Breech...	Inside	10.5	1.00	61,460	do			} Fourth casting.
1029	12	40	do	Radial	10.5	1.00	61,170	do			
1030	12	32	Muzzle	Inside	10.5	1.00	64,220	do			
1004	13	2	Breech...	Inside	10.5	1.00	59,790	do			
1005	13	10	do	Radial	10.5	1.00	59,580	do			
1006	13	2	Muzzle	Inside	10.5	1.00	55,060	do			
1031	13	12	Breech...	Inside	10.5	1.00	61,500	do			} Second casting.
1032	13	20	do	Radial	10.5	1.00	62,800	do			
1033	13	12	Muzzle	Inside	10.5	1.00	62,380	do			
1040	13	12	Breech...	Inside	10.5	1.00	65,480	do			} Extra disk from second casting.
1041	13	20	do	Radial	10.5	1.00	64,460	do			
1007	14	2	Breech...	Inside	10.5	1.00	60,300	do			
1008	14	10	do	Radial	10.5	1.00	59,100	do			
1009	14	2	Muzzle	Inside	10.5	1.00	57,500	do			
1024	14	12	Breech...	Inside	10.5	1.00	60,900	do			} Second casting.
1035	14	20	do	Radial	10.5	1.00	61,780	do			
1036	14	12	Muzzle	Inside	10.5	1.00	59,600	do			
1013	15	2	Breech...	Inside	10.5	1.00	56,500	do			
1014	15	10	do	Radial	10.5	1.00	57,580	do			
1015	15	2	Muzzle	Inside	10.5	1.00	55,680	do			
1037	15	12	Breech...	Inside	10.5	1.00	61,650	do			} Second casting.
1038	15	20	do	Radial	10.5	1.00	61,560	do			
1039	15	12	Muzzle	Inside	10.5	1.00	59,870	do			
1016	16	2	Breech...	Inside	10.5	1.00	57,700	do			
1017	16	10	do	Radial	10.5	1.00	59,380	do			
1018	16	2	Muzzle	Inside	10.5	1.00	56,440	do			



TABULATION OF COMPRESSION SPECIMENS FROM CAST-IRON BODIES—Continued.

No. of test.	Number of—		Position in body.	Location of specimen.	Total length.	Sectional area.	Ultimate strength per square inch.	Manner of failure.	Specific gravity.	Hardness.	Remarks.
	Mortar.	Specimen.									
1068	24	3	Muzzle ...	Inside ...	Inches 10.5	Sq. inch. 1.00	Pounds. 59,900	Triple flexure.....			
1070	25	2	Breech....	Inside ...	10.5	1.00	58,040	do.....			
1071	25	10	do.....	Radial ...	10.5	1.00	59,309	do.....			
1072	25	2	Muzzle ...	Inside ...	10.5	1.00	59,700	do.....			
1076	26	2	Breech....	Inside ...	10.5	1.00	62,520	do.....			
1077	26	10	do.....	Radial ...	10.5	1.00	62,580	do.....			
1078	26	2	Muzzle ...	Inside ...	10.5	1.00	62,750	do.....			
1079	27	2	Breech....	Inside ...	10.5	1.00	59,100	do.....			
1080	27	10	do.....	Radial ...	10.5	1.00	58,680	do.....			
1081	27	2	Muzzle ...	Inside ...	10.5	1.00	58,460	do.....			



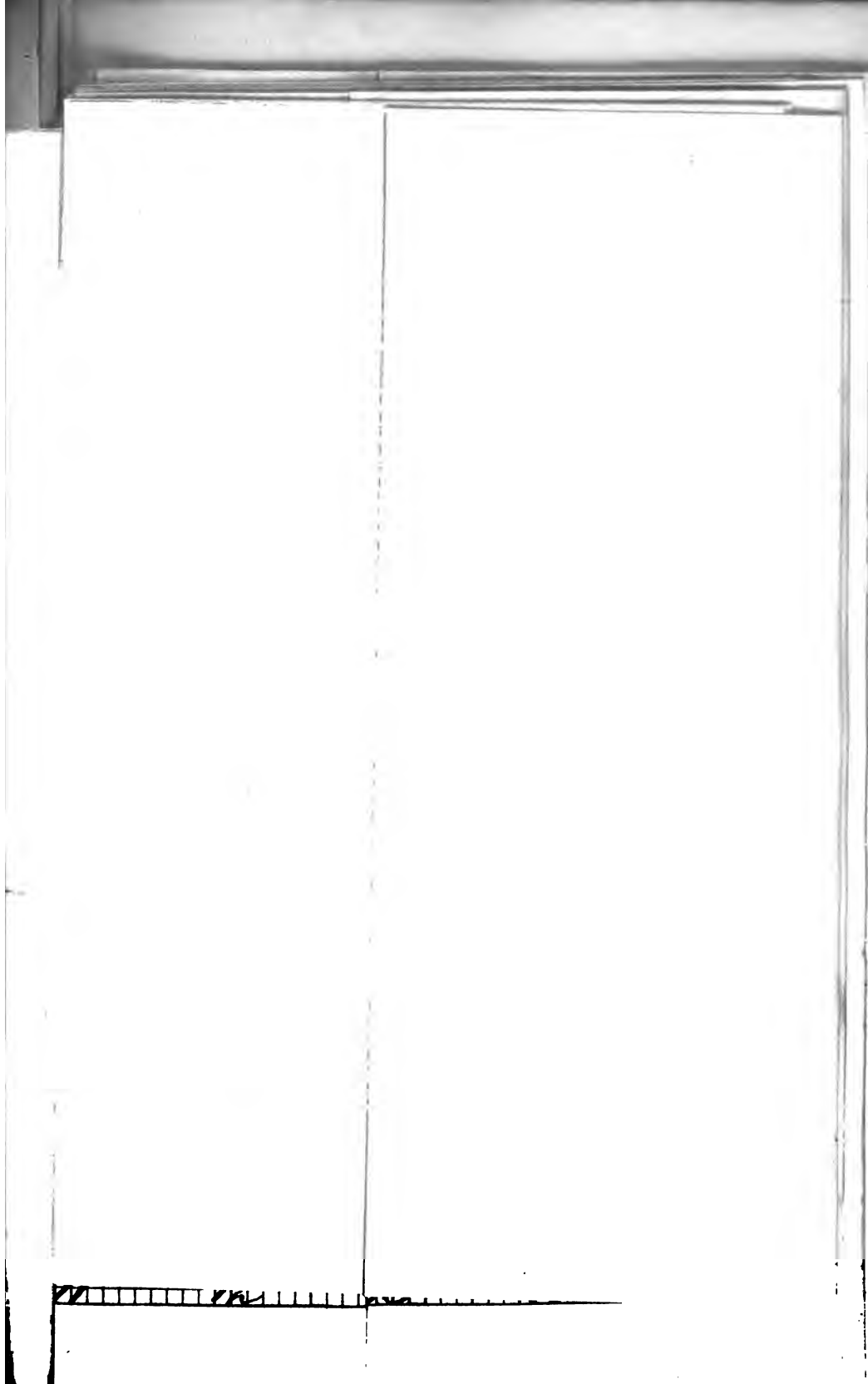
**12-INCH B. L. RIFLED MORTARS.**

Diagrams showing chemical composition, tensile strength, specific gravity, and hardness of cast-iron bodies.

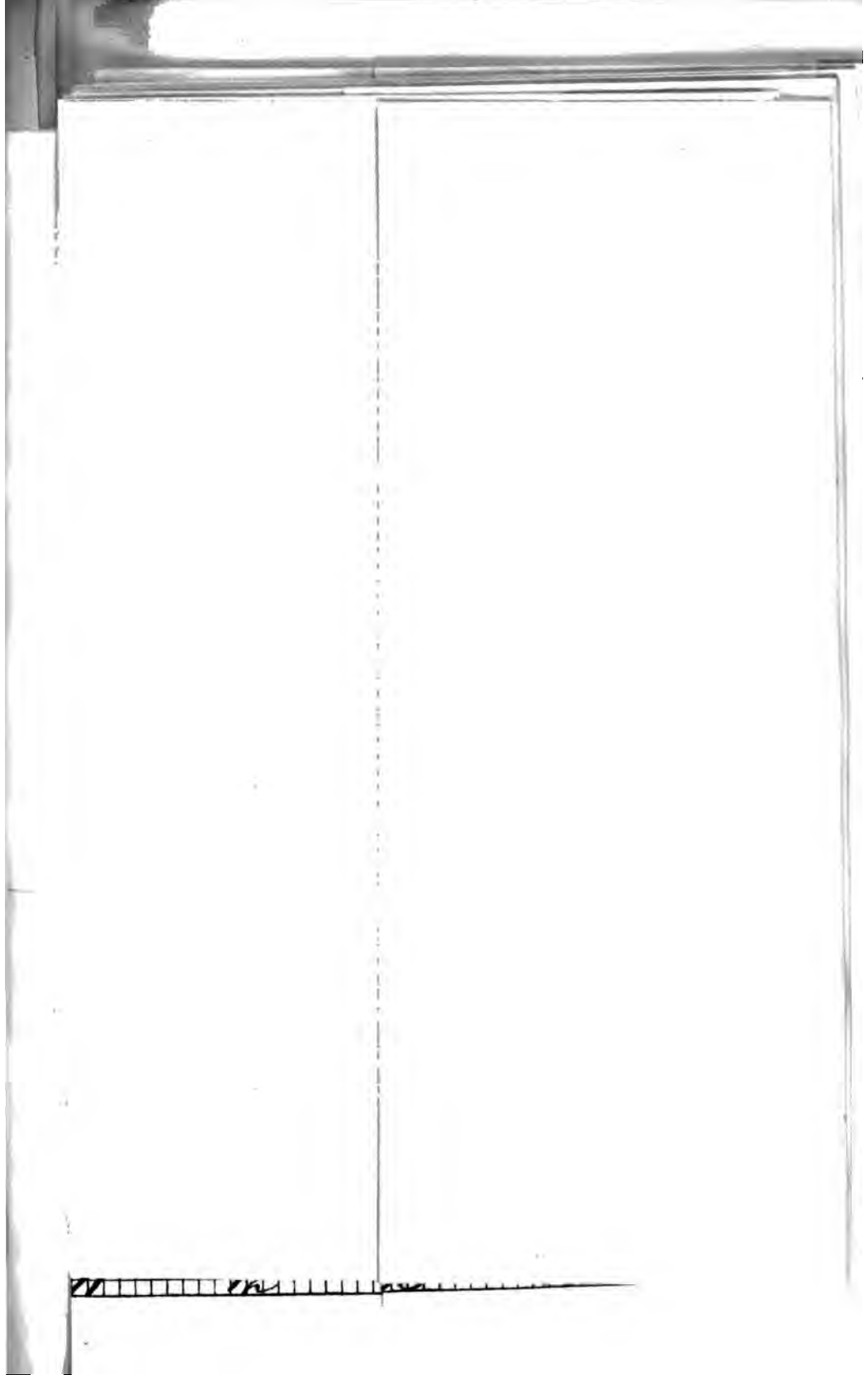
The full lines in the diagrams represent results obtained with the long tension specimens.

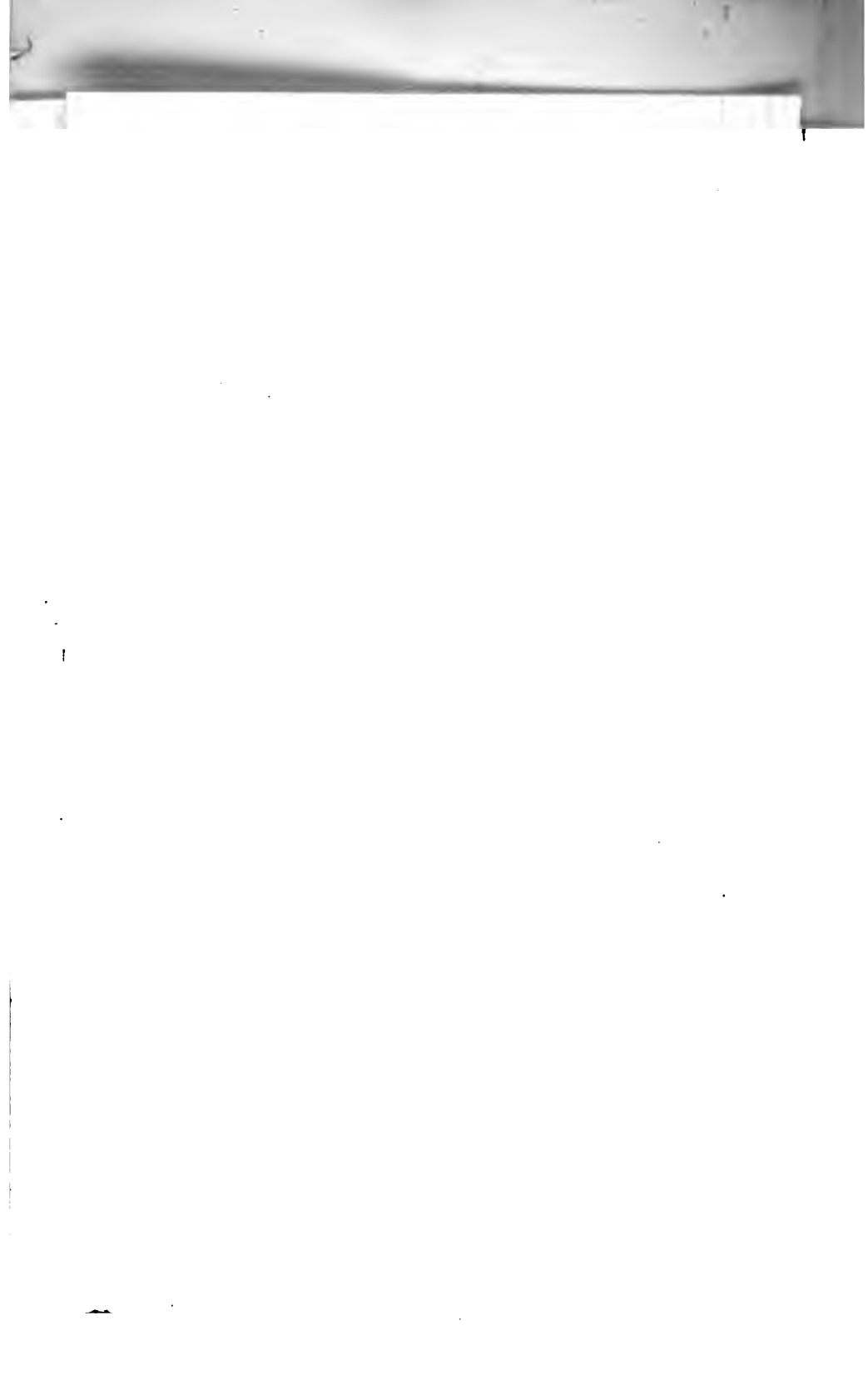
The mean results of the grooved tenacity specimens are plotted in dotted lines, rejecting from the averages and indicating on the diagrams by dotted circles specimens which gave exceptionally high tensile strength.

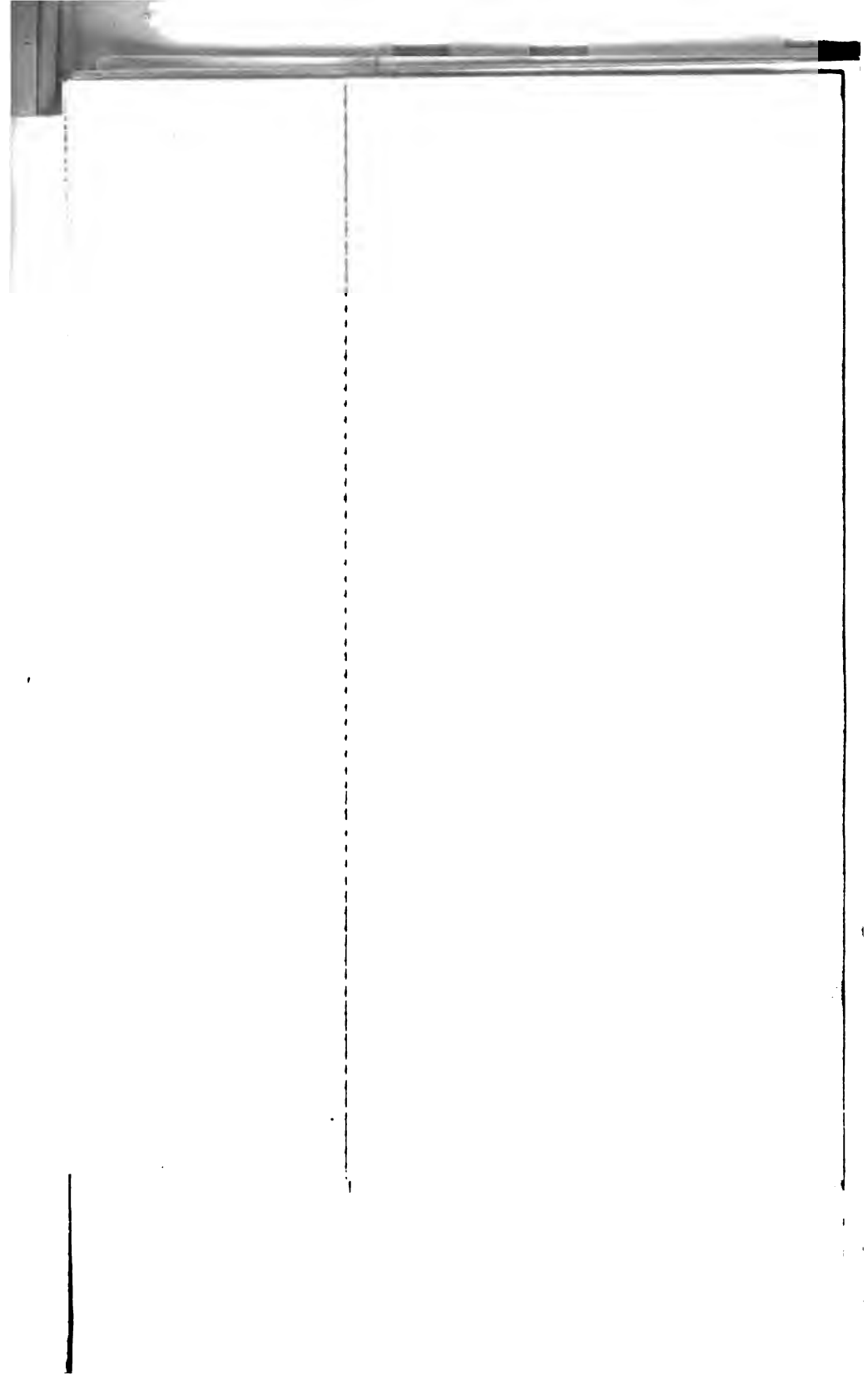


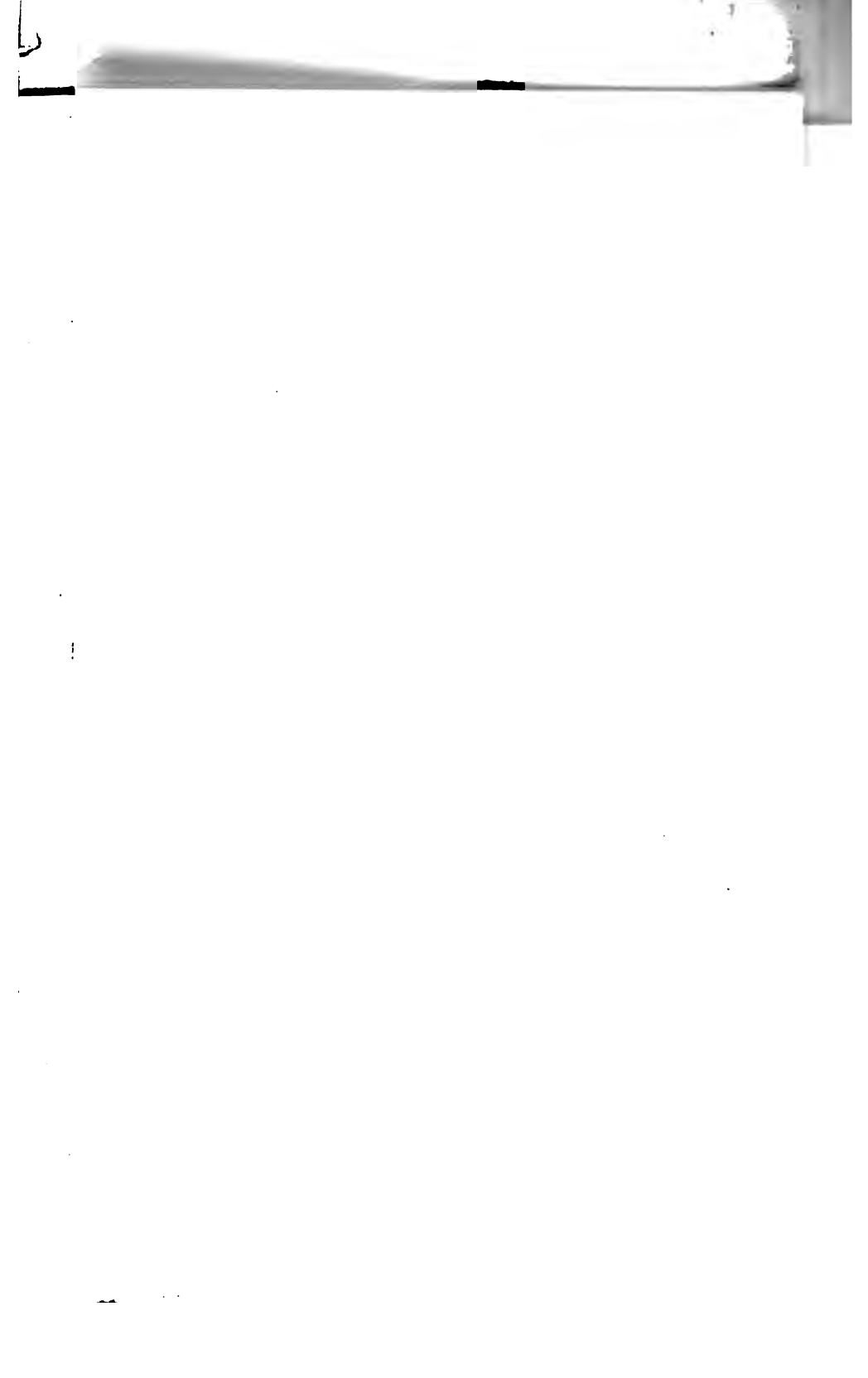




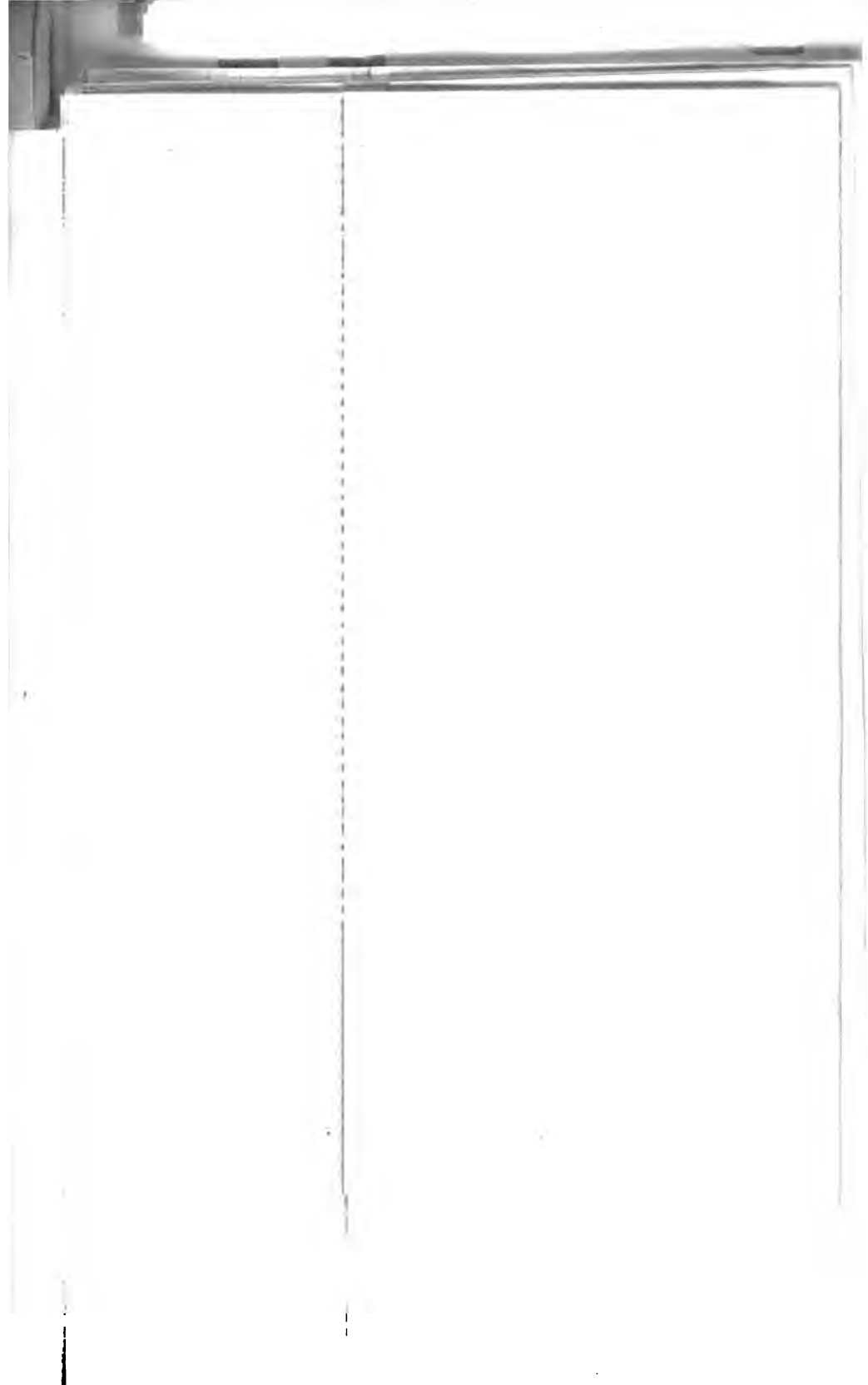




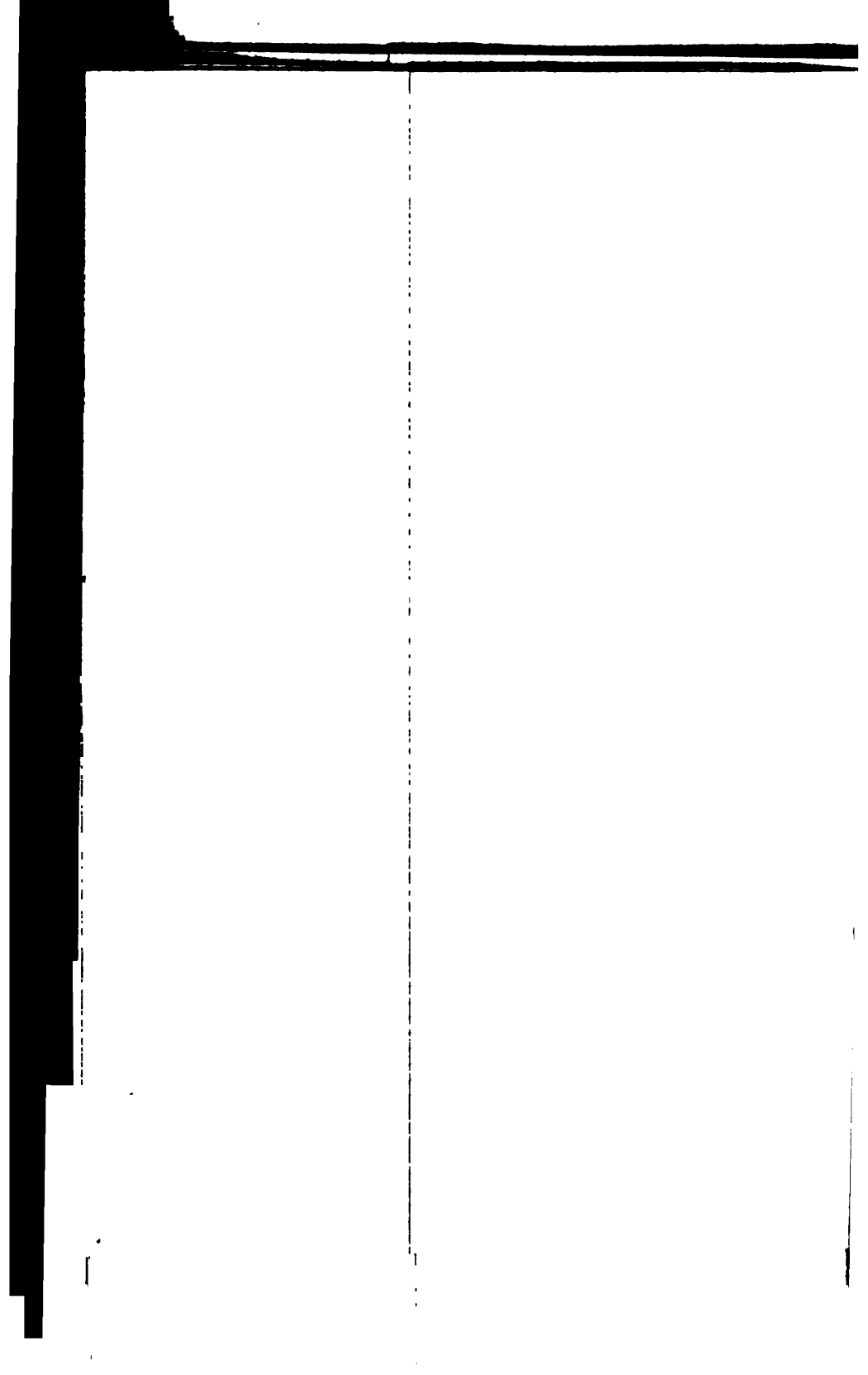


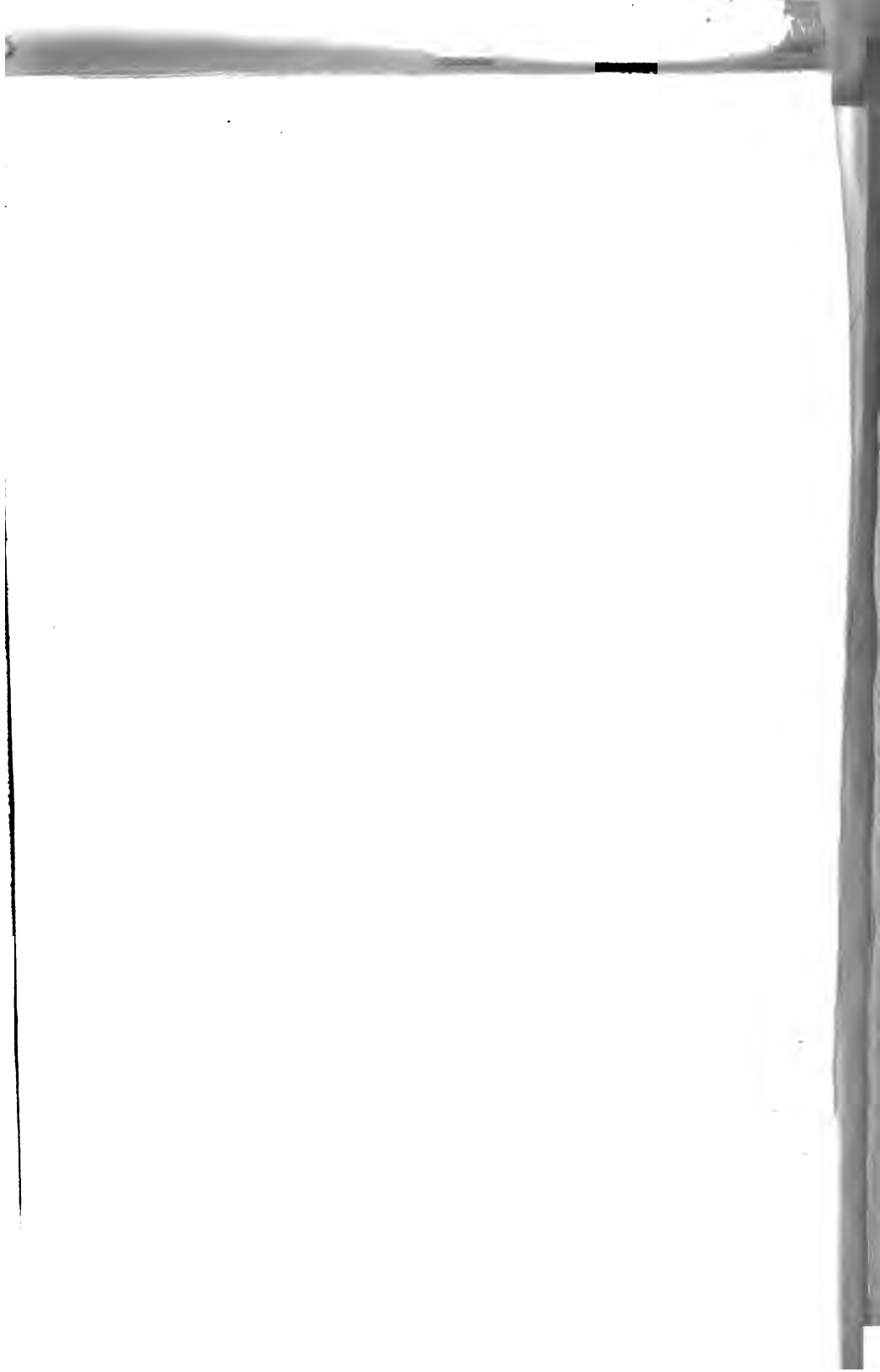


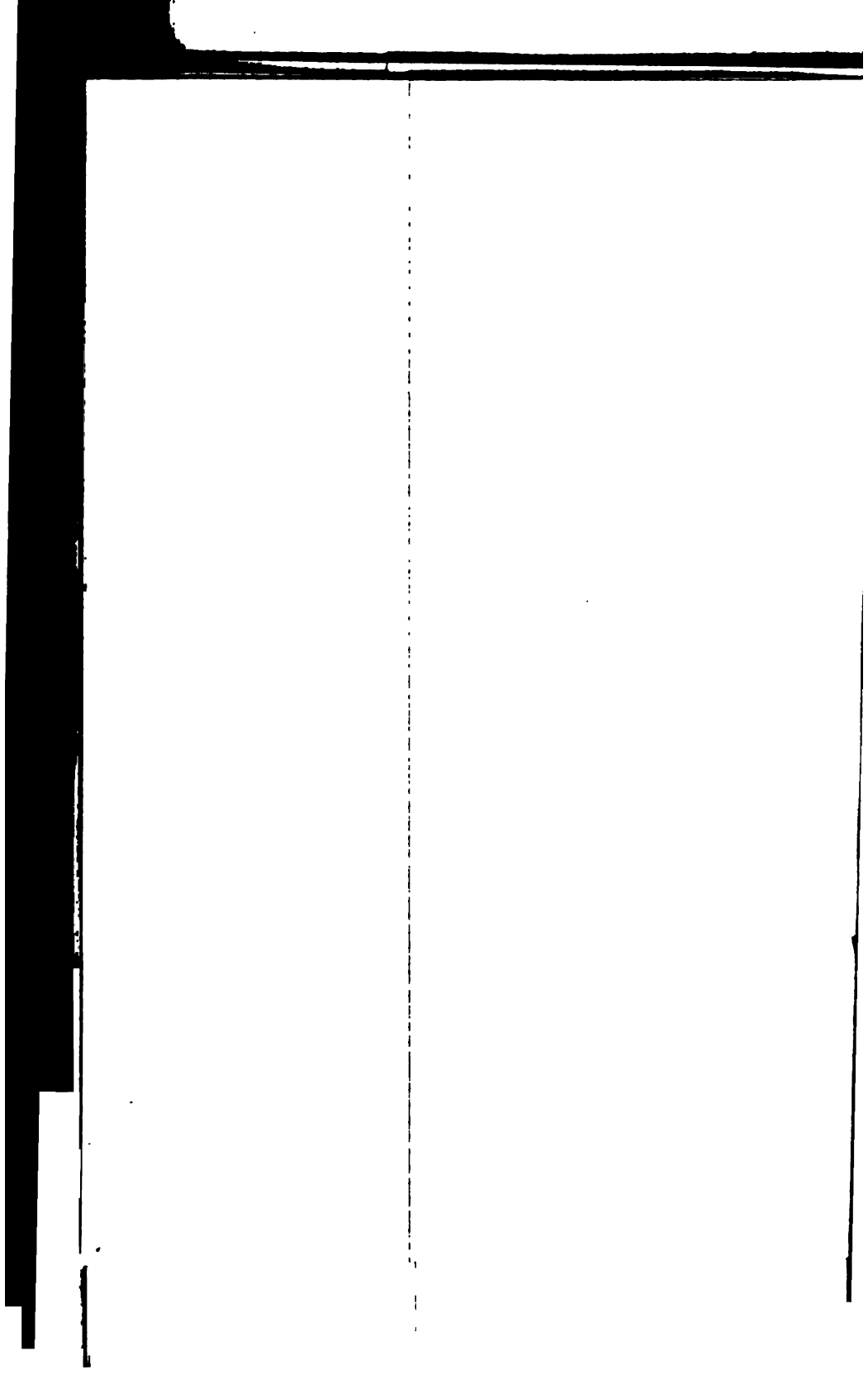


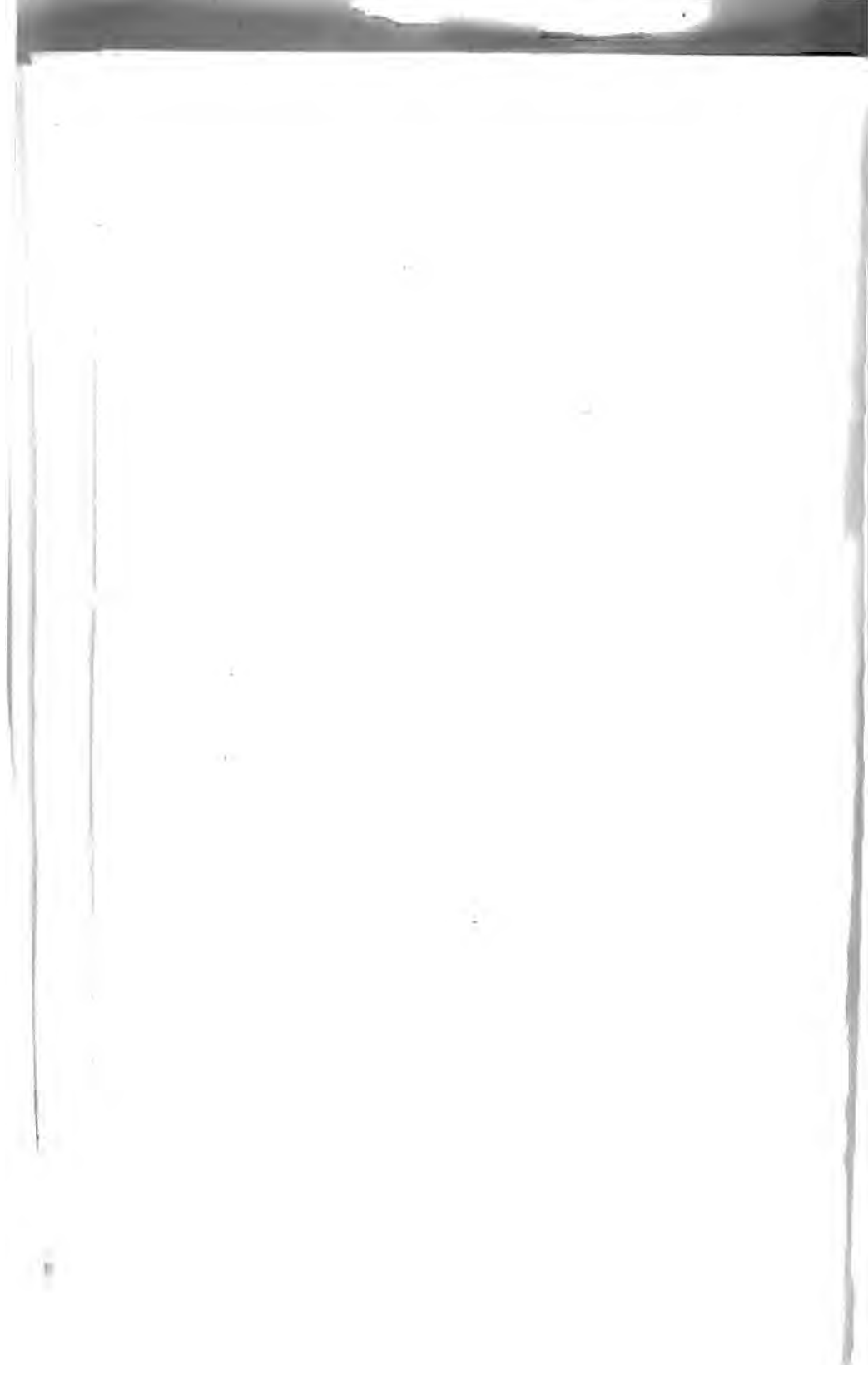


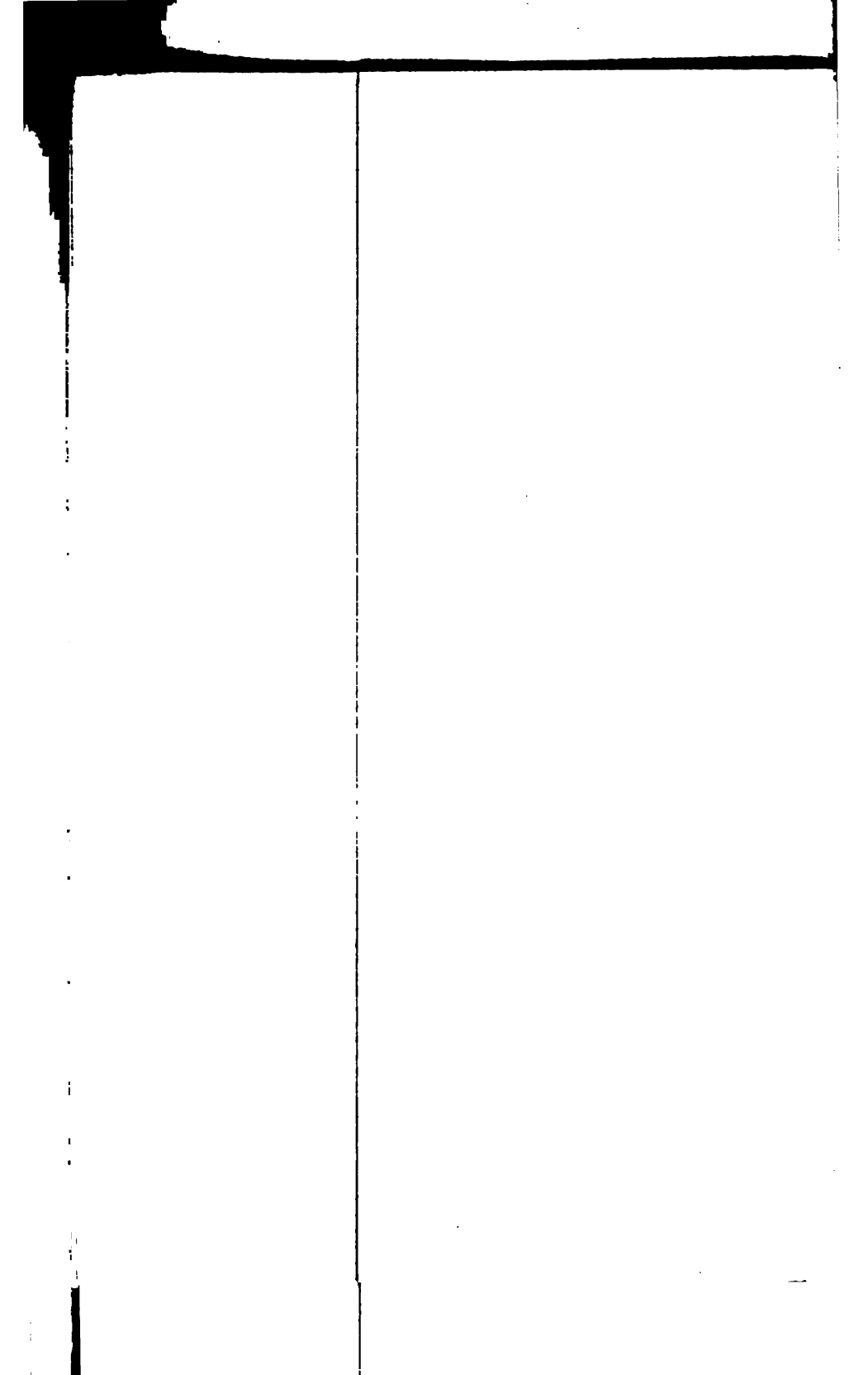


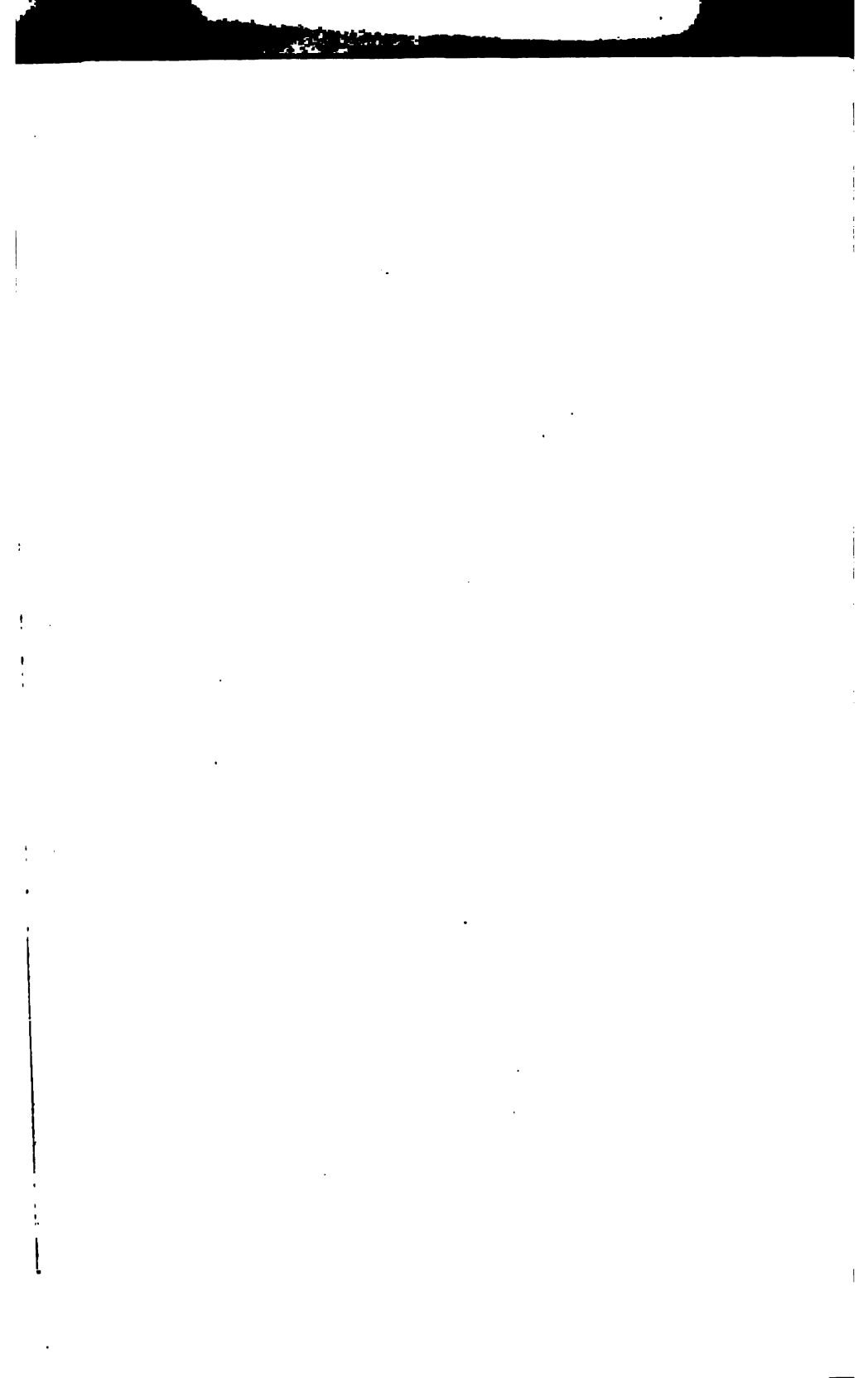




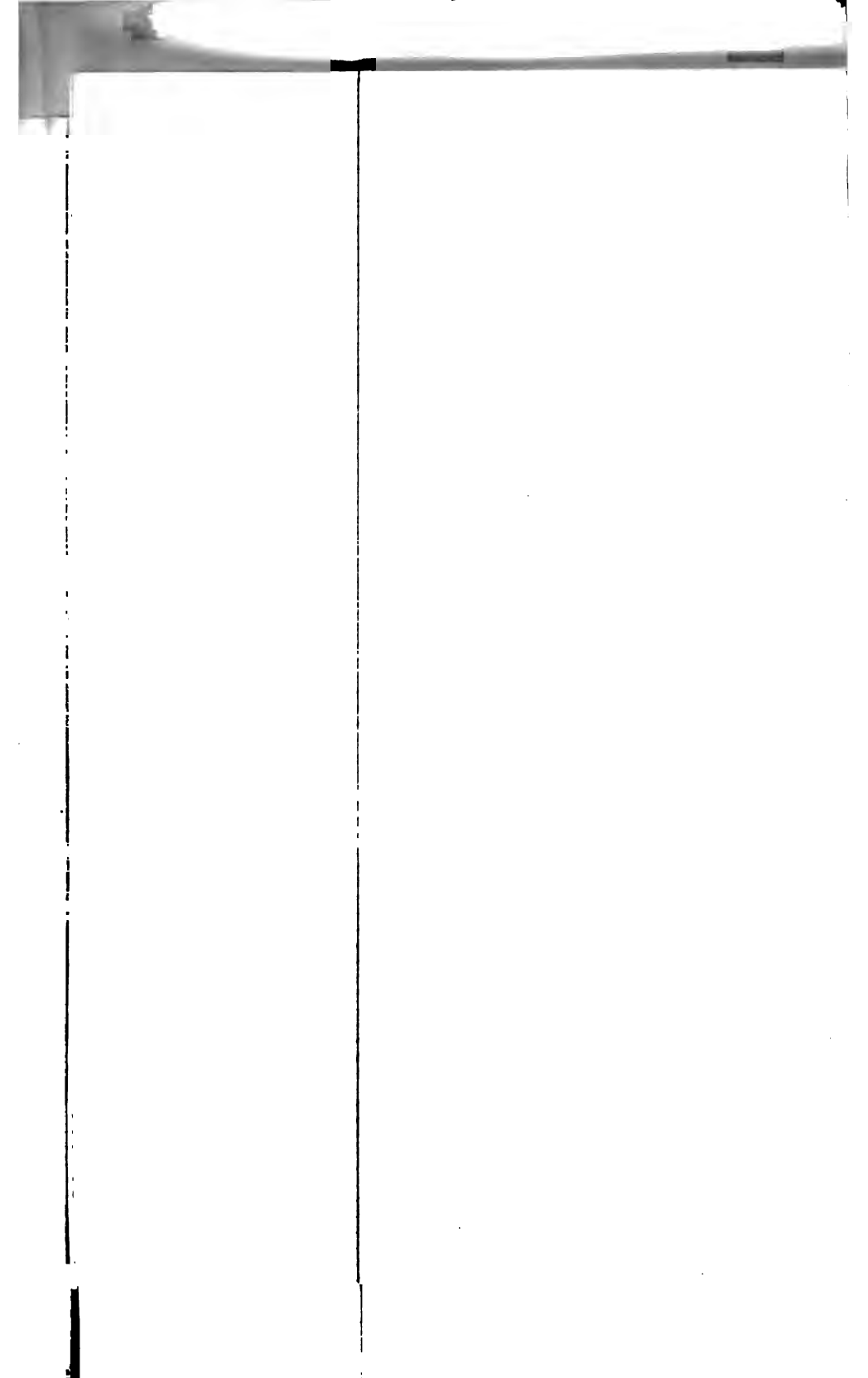












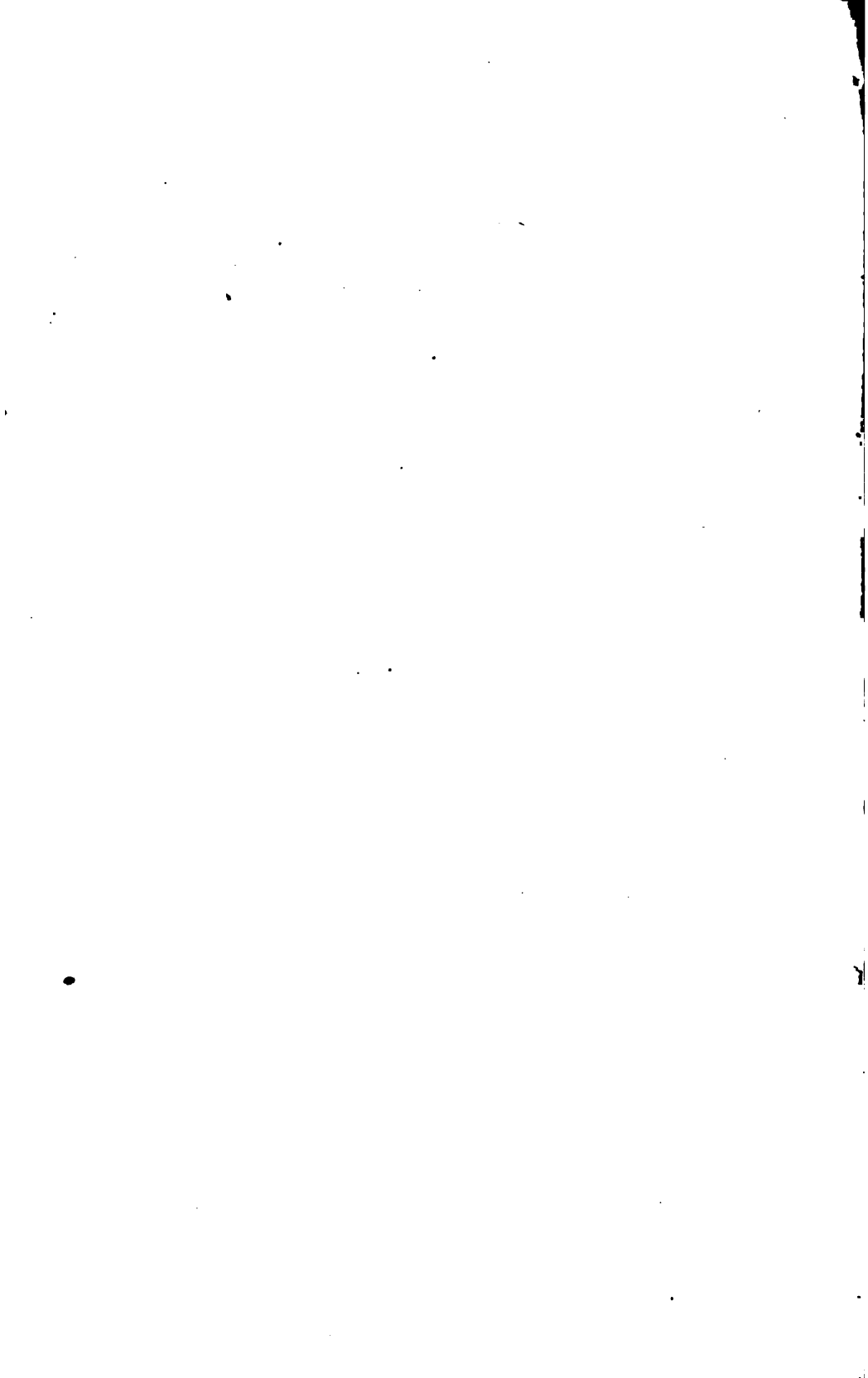


## 12-INCH B. L. RIFLED MORTARS.

## SPECIFIC GRAVITY AND HARDNESS OF STEEL HOOPS.

No tension tests of these specimens.

No. of mortar.	Mark on specimen.	Specific gravity.	Hardness.	Remarks.
46	12 M R <sub>46</sub> A <sub>5</sub> -R <sub>1</sub> M	7.8261	22.90	
47	12 M R <sub>47</sub> A <sub>5</sub> -R <sub>1</sub> M	7.8422	22.64	
61	12 M R <sub>61</sub> A <sub>5</sub> -R <sub>1</sub> M	7.8408	22.52	
64	12 M R <sub>64</sub> A <sub>5</sub> -R <sub>1</sub> M	7.8468	21.89	
48	12 M R <sub>48</sub> A <sub>5</sub> -R <sub>1</sub> M	7.8444	27.49	
49	12 M R <sub>49</sub> A <sub>5</sub> -R <sub>1</sub> M	7.8402	21.40	
50	12 M R <sub>50</sub> A <sub>5</sub> -R <sub>1</sub> M	7.8442	21.89	
56	12 M R <sub>56</sub> A <sub>5</sub> -R <sub>1</sub> M	7.8394	22.90	
57	12 M R <sub>57</sub> A <sub>5</sub> -R <sub>1</sub> M	7.8397	17.90	
58	12 M R <sub>58</sub> A <sub>5</sub> -R <sub>1</sub> M	7.8485	22.64	
59	12 M R <sub>59</sub> A <sub>5</sub> -R <sub>1</sub> M	7.8430	20.62	
72	12 M R <sub>72</sub> A <sub>5</sub> -R <sub>1</sub> M	7.8421	23.84	
73	12 M R <sub>73</sub> A <sub>5</sub> -R <sub>1</sub> M	7.8433	21.52	
32	12 M R <sub>32</sub> A <sub>5</sub> -R <sub>1</sub> M	7.8382	24.40	
33	12 M R <sub>33</sub> A <sub>5</sub> -R <sub>1</sub> M	7.8388	22.26	
34	12 M R <sub>34</sub> A <sub>5</sub> -R <sub>1</sub> M	7.8497	19.81	
35	12 M R <sub>35</sub> A <sub>5</sub> -R <sub>1</sub> M	7.8396	21.05	
36	12 M R <sub>36</sub> A <sub>5</sub> -R <sub>1</sub> M	7.8452	19.06	
37	12 M R <sub>37</sub> A <sub>5</sub> -R <sub>1</sub> M	7.8433	21.52	
38	12 M R <sub>38</sub> A <sub>5</sub> -R <sub>1</sub> M	7.8503	21.17	
39	12 M R <sub>39</sub> A <sub>5</sub> -R <sub>1</sub> M	7.8525	19.50	
40	12 M R <sub>40</sub> A <sub>5</sub> -R <sub>1</sub> M	7.8455	20.03	
69	12 M R <sub>69</sub> A <sub>5</sub> -R <sub>1</sub> M	7.8481	20.70	
43	12 M R <sub>43</sub> B <sub>5</sub> -R <sub>1</sub> M	7.8435	24.54	
51	12 M R <sub>51</sub> B <sub>5</sub> -R <sub>1</sub> M	7.8498	21.64	
54	12 M R <sub>54</sub> B <sub>5</sub> -R <sub>1</sub> M	7.8391	21.89	
55	12 M R <sub>55</sub> B <sub>5</sub> -R <sub>1</sub> M	7.8473	23.43	
60	12 M R <sub>60</sub> B <sub>5</sub> -R <sub>1</sub> M	7.8463	19.92	
62	12 M R <sub>62</sub> B <sub>5</sub> -R <sub>1</sub> M	7.8412	18.58	
63	12 M R <sub>63</sub> B <sub>5</sub> -R <sub>1</sub> M	7.8430	21.40	
65	12 M R <sub>65</sub> B <sub>5</sub> -R <sub>1</sub> M	7.8466	20.93	
68	12 M R <sub>68</sub> B <sub>5</sub> -R <sub>1</sub> M	7.8449	22.02	
71	12 M R <sub>71</sub> B <sub>5</sub> -R <sub>1</sub> M	7.8479	22.77	
52	12 M R <sub>52</sub> B <sub>5</sub> -R <sub>1</sub> M	7.8449	19.60	
53	12 M R <sub>53</sub> B <sub>5</sub> -R <sub>1</sub> M	7.8426	20.70	
66	12 M R <sub>66</sub> B <sub>5</sub> -R <sub>1</sub> M	7.8435	20.25	
67	12 M R <sub>67</sub> B <sub>5</sub> -R <sub>1</sub> M	7.8305	20.36	
70	12 M R <sub>70</sub> B <sub>5</sub> -R <sub>1</sub> M	7.8469	23.70	



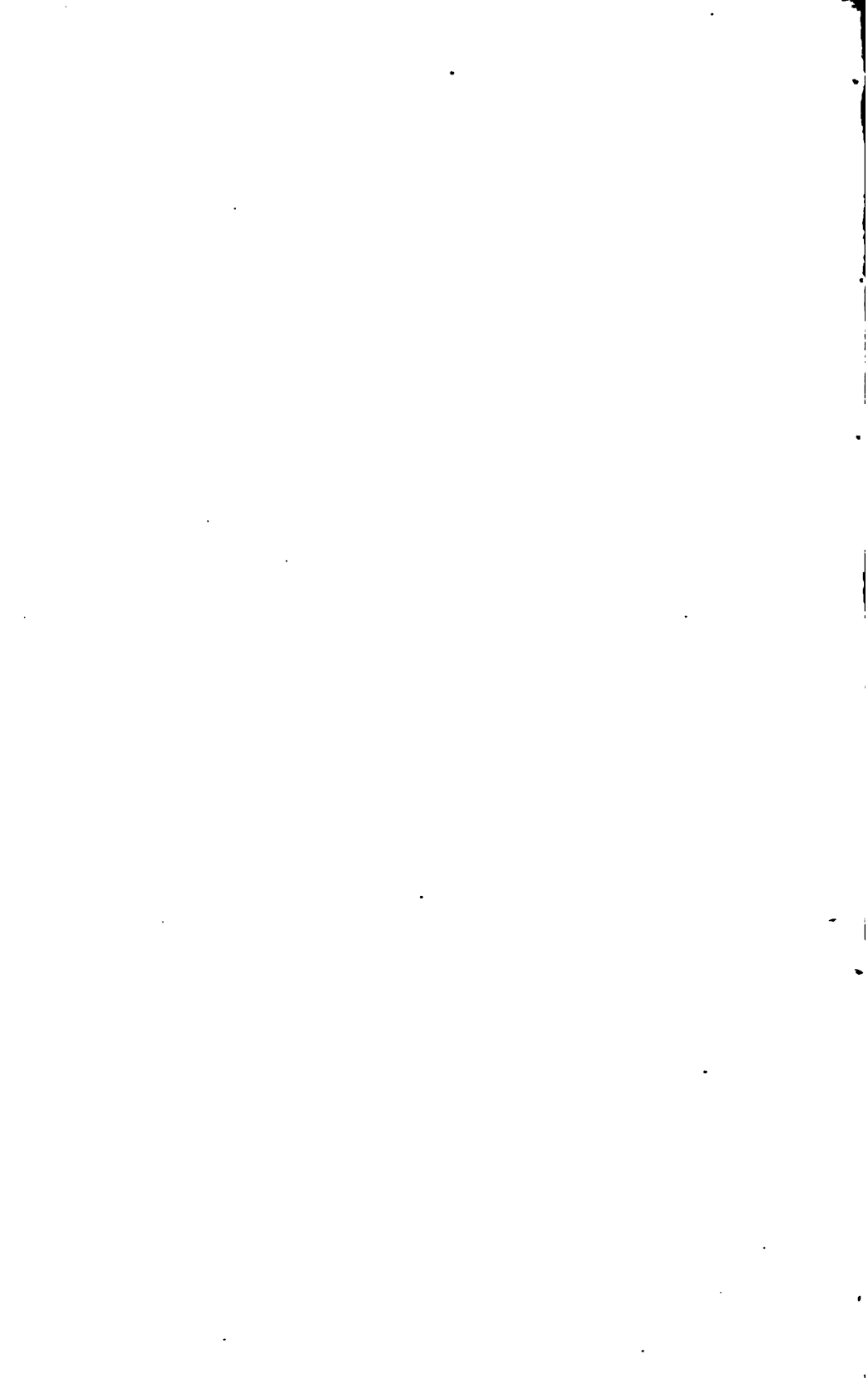
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**SQUARE STEEL WIRE.**

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**".15 SQUARE TINNED STEEL WIRE.**

**WIRE FROM COILS FOR USE ON 10-INCH WOODBRIDGE  
W. W. GUN.**

**WIRE MANUFACTURED BY THE TRENTON IRON COMPANY.**

**REJECTED COIL.**

Mean sectional area,  $".1503 \times ".1498 = .0225$  square inch.  
Specimen  $21\frac{1}{2}$  feet long between jaws of the testing machine.

No. 5489.

**FIRST FRACTURE.**

Tensile strength, 3,273 pounds = 145,470 pounds per square inch.  
Area at fracture,  $".1495 \times ".1493 = .0223$  square inch.  
Contraction of area, 00.9 per cent.  
Fractured about 12" from middle of length. Appearance silky,  
oblique.

No. 5490.

**SECOND FRACTURE.**

Specimen 9 feet long.  
Tensile strength, 3,365 pounds = 149,560 pounds per square inch.  
Area at fracture,  $".1492 \times ".1488 = .0222$  square inch.  
Contraction of area, 1.3 per cent.  
Fractured 39" from face of jaws. Appearance silky, oblique.

No. 5491.

**THIRD FRACTURE.**

Specimen 3 feet 9 inches long.  
Tensile strength, 3,280 pounds = 145,780 pounds per square inch.  
Area at fracture,  $".1494 \times ".1493 = .0223$  square inch.  
Contraction of area, 00.9 per cent.  
Fractured at middle of the length. Appearance silky, conoidal.

FOURTH FRACTURE.

Specimen 3 feet 10 inches long.

Tensile strength, 3370 pounds = 149,780 pounds per square inch.

Area at fracture, ".1490 × ".1492 = .0222 square inch.

Contraction of area, 1.3 per cent.

Fractured at face of jaws. Appearance silky, conoidal.

*Lot of five samples from same coil of wire.*

No. of test.	Dimensions.		Sectional area.	Tensile strength.		Area at fracture.			Contraction of area.
	Width.	Thick-ness.		Total.	Per square inch.				
	<i>Inch.</i>	<i>Inch.</i>	<i>Sq. in.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Sq. in.</i>	<i>Per ct.</i>
5403	.1497	.1496	.0224	3,548	158,390	.1486	× .1486	= .0221	1.3
5404	.1497	.1493	.0224	3,572	159,460	.1486	× .1485	= .0221	1.3
5405	.1498	.1492	.0224	2,980	133,040	.1492	× .1491	= .0222	0.9
5496	.1500	.1494	.0224	2,855	127,460	.1492	× .1489	= .0222	0.9
5497	.1497	.1493	.0224	3,585	160,040	.1486	× .1486	= .0221	1.3

Fractures silky, conoidal.

Nos. 5494-5497 were taken from one end of coil.

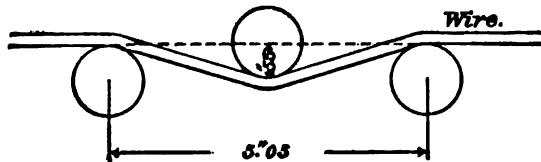
*Lot of five samples from same coil of wire.*

No. of test.	Dimensions.		Sectional area.	Tensile strength.		Area at fracture.			Contraction of area.
	Width.	Thick-ness.		Total.	Per square inch.				
	<i>Inch.</i>	<i>Inch.</i>	<i>Sq. in.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Sq. in.</i>	<i>Per ct.</i>
5498	.1496	.1497	.0224	3,548	158,390	.1486	× .1486	= .0221	1.3
5499	.1494	.1497	.0224	1,460	65,180	.....	.....	.....	.....
5500	.1492	.1497	.0223	2,689	120,580	.....	.....	.....	.....
5501	.1496	.1494	.0223	1,900	87,890	.....	.....	.....	.....
5502	.1497	.1493	.0224	1,345	60,040	.....	.....	.....	.....

No. of test.	Fractures.	Remarks.
5498	Silky .....	} Middle bend took natural curve of coil. Tested on 3-pin fixture.
5499	do .....	
5500	do .....	
5501	do .....	
5502	do .....	

Nos. 5499-5502 were taken from one end of coil.

Arrangement of pins in 3-pin fixture.





FOUR SAMPLES OF ".15 SQUARE TINNED STEEL WIRE FROM SAME COIL.

No. 5503.

Sectional area,  $".1493 \times .1495 = .022$  square inch.

Gauged length, 10".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
110	5,000	0.	0.	
220	10,000	.0025	.....	
440	20,000	.0061	.....	
660	30,000	.0099	.....	
880	40,000	.0136	.....	
1,100	50,000	.0178	.....	
1,320	60,000	.0219	.....	
1,540	70,000	.0262	.....	
1,760	80,000	.0310	.....	
1,980	90,000	.0363	.....	
2,200	100,000	.0420	.0040	
2,420	110,000	.0485	.....	
2,640	120,000	.0558	.....	Elastic limit.
2,860	130,000	.0649	.0144	
3,080	140,000	.0735	.0199	
3,302	150,000	.....	.....	Tensile strength.
0	0	.10	.....	= 1.0 per cent.

Area at fracture,  $".130 \times ".130 = .017$  square inch.

Contraction of area, 22.7 per cent.

Fractured outside the gauged length. Appearance, silky.

No. 5504.

Sectional area,  $".1500 \times ".1500 = .0225$  square inch.

Gauged length, 10".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
112	5,000	0.	0.	
225	10,000	.0019	.....	
450	20,000	.0052	.....	
675	30,000	.0087	.....	
900	40,000	.0119	.....	
1,125	50,000	.0154	.....	
1,350	60,000	.0187	.....	
1,575	70,000	.0229	.....	
1,800	80,000	.0262	.....	
2,025	90,000	.0300	.....	
2,250	100,000	.0340	.0012	
2,475	110,000	.0380	.....	
2,700	120,000	.0420	.....	
2,925	130,000	.0466	.0030	
3,150	140,000	.0512	.....	Elastic limit.
3,375	150,000	.0575	.....	
3,600	160,000	.0650	.0098	
3,746	166,490	.....	.....	Tensile strength.
0	0	.01	.....	= 0.1 per cent.

Area at fracture,  $".131 \times ".131 = .0172$  square inch.

Contraction of area, 23.5 per cent.

Fractured outside the gauged length at the grips. Appearance, silky.

No. 5505.

Sectional area,  $.''1498 \times .''1496 = .0224$  square inch.  
Gauged length, 10''.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
112	5,000	0.	0.	
224	10,000	.0028	.....	
448	20,000	.0089	.....	
672	30,000	.0103	.....	
896	40,000	.0143	.....	
1,120	50,000	.0182	.....	
1,344	60,000	.0226	.....	
1,568	70,000	.0270	.....	
1,792	80,000	.0318	.....	
2,016	90,000	.0364	.....	
2,240	100,000	.0417	.0040	
2,464	110,000	.0471	.....	Elastic limit.
2,688	120,000	.0543	.....	
2,912	130,000	.0620	.0109	Tensile strength. = 1.2 per cent.
3,136	140,000	.0727	.0169	
3,738	166,875	.....	.....	
0	0	.12	.....	

Area at fracture  $.''145 \times .''145 = .0210$  square inch.  
Contraction of area, 6.3 per cent.  
Fractured at jaws of machine. Appearance silky, oblique.

No. 5506.

Sectional area,  $.''1494 \times .''1494 = .0223$  square inch.  
Gauged length, 10''.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
112	5,000	0.	0.	
223	10,000	.0027	.....	
446	20,000	.0063	.....	
669	30,000	.0101	.....	
892	40,000	.0141	.....	
1,115	50,000	.0179	.....	
1,338	60,000	.0213	.....	
1,561	70,000	.0259	.....	
1,784	80,000	.0300	.....	
2,007	90,000	.0343	.....	
2,230	100,000	.0389	.0033	
2,453	110,000	.0434	.....	Elastic limit.
2,676	120,000	.0499	.....	
2,899	130,000	.0564	.0082	Tensile strength. = 0.2 per cent.
3,122	140,000	.0649	.....	
3,345	150,000	.0771	.....	
3,666	163,950	.....	.....	
0	0	.02	.....	

Area at fracture,  $.''131 \times .''130 = .0170$  square inch.  
Contraction of area, 23.8 per cent.  
Fractured at jaws of machine. Appearance, silky.

FOUR SPECIMENS FROM ADJOINING PARTS OF SAME WIRE.

Specimens marked — tested as cut from coil, except slight straightening in rolls.

Specimens marked × curvature of coil reversed to radius of 18", then nearly straightened in rolls.

No. of test.	Marks.	Dimensions.			Tensile strength.		Area at fracture.	Contraction of area.
		Width.	Thick-ness.	Sectional area.	Total.	Per square inch.		
		<i>Inch.</i>	<i>Inch.</i>	<i>Sq. In.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>In. In. Sq. In.</i>	<i>Per cent.</i>
5511	×	.1495	.1490	.0223	3, 148	141, 170	.145 × .145 = .0210	5.8
5512	—	.1492	.1493	.0223	3, 552	159, 280	.146 × .146 = .0213	4.5
5513	×	.1495	.1491	.0223	3, 396	152, 380	.148 × .148 = .0219	1.8
5514	—	.1492	.1494	.0223	3, 604	164, 300	.148 × .148 = .0219	1.8

Fractures, silky, conoidal ends.

SIX SPECIMENS, ".15 SQUARE, TINNED STEEL WIRE FROM SAME COIL.

Rejected after three breaks in the winding machine used on the construction of 10-inch W. W. gun.

No. of test.	Marks.	Treatment.	Dimensions.		Sectional area.	Tensile strength.	
			Width.	Thick-ness.		Total.	Per square inch.
			<i>Inch.</i>	<i>Inch.</i>	<i>Sq. In.</i>	<i>Pounds.</i>	<i>Pounds.</i>
5524	I	} Taken from winding reel. {	.1496	.1497	.0224	3, 704	165, 360
5525	I		Curve of coil reversed.	.1496	.1497	.0224	3, 734
5526	II	} Curve of coil reversed to cur- {	.1496	.1496	.0224	3, 498	156, 180
5527	II		ature of reel twice.	.1496	.1495	.0224	3, 285
5528	III	} Curve of coil reversed to cur- {	.1495	.1495	.0224	3, 756	167, 680
5529	III		ature of reel three times.	.1496	.1495	.0224	3, 622

Contraction of area inappreciable.

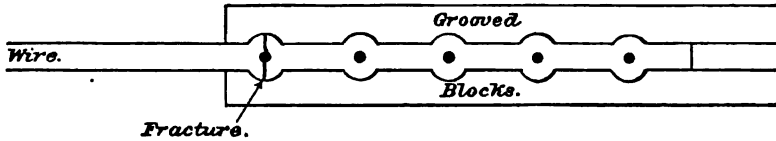
Fractures silky.

Diameter of reel of winding machine 42½".

Tensile test of wire fastening used on Woodbridge 10" wire-wrapped gun.

".15 square tinned steel wire.

Ends secured in grooved blocks by expansion of metal by means of center punch into drilled pockets.



Five pockets for each wire end.

Tensile strength, 2,948 pounds.

Fractured wire at first pocket.

THREE SAMPLES ".15 SQUARE TINNED STEEL WIRE, MANUFACTURED BY R. H. WOLFF & CO.

Straightened in rolls before testing; from coil of 20" radius.

No. 5507.

Sectional area,  $".1495 \times ".1500 = .0224$  square inch.

Gauged length, 10".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	Pounds.	Inch.	Inch.	
112	5,000	0.	0.	Initial load.
224	10,000	.0024	.....	
448	20,000	.0080	.....	
672	30,000	.0092	.....	
896	40,000	.0125	.....	
1,120	50,000	.0159	.....	
1,344	60,000	.0192	.....	
1,568	70,000	.0234	.....	
1,792	80,000	.0275	.....	
2,016	90,000	.0314	.....	
2,240	100,000	.0359	.0023	
2,464	110,000	.0398	.....	
2,688	120,000	.0444	.....	
2,912	130,000	.0485	.....	
3,136	140,000	.0535	.0053	
3,360	150,000	.0592	.....	
3,584	160,000	.0642	.....	
3,808	170,000	.0620	.....	
4,032	180,000	.0684	.....	Elastic limit.
4,256	190,000	.0772	.....	
4,480	200,000	.0894	.0150	Tensile strength. = 0.5 per cent.
5,112	228,210	.....	.....	
0	0	.05	.....	

Area at fracture,  $".126 \times ".126 = .0159$  square inch.

Contraction of area, 29.0 per cent.

Fractured outside the gauged length. Appearance, silky.

No. 5508.

Tested on 3-pin fixture.

Sectional area,  $".1495 \times ".1495 = .0224$  square inch.

Tensile strength, 4,610 pounds = 205,800 pounds per square inch.

Area at fracture,  $".123 \times ".123 = .0151$  square inch.

Contraction of area, 32.6 per cent.

Appearance of fracture, silky.

No. 5509.

Tested on 3-pin fixture.

Sectional area,  $'' .1508 \times '' .1492 = .0225$  square inch.

Tensile strength, 4,687 pounds = 208,310 pounds per square inch.

Area at fracture,  $'' .120 \times '' .120 = .0144$  square inch.

Contraction of area, 36.0 per cent.

Appearance of fracture, silky.

**BRONZE FROM WATERTOWN ARSENAL FOUNDRY.**

No. 5735.

*Specimen from a sample cast of bronze mixture to be used for 8-inch B. L. rifle carriage casting.*

Sectional area, .50 square inch.

Elastic limit, 6,800 pounds = 13,600 pounds per square inch.

Tensile strength, 16,640 pounds = 33,280 pounds per square inch.

Elongation in 4 inches,  $'' .72 = 18.0$  per cent.Elongation of inch sections,  $'' .16$ ,  $'' .17$ ,  $'' .21^*$ ,  $'' .18$ .Diameter at fracture,  $'' .72$ ; area, .407 square inch.

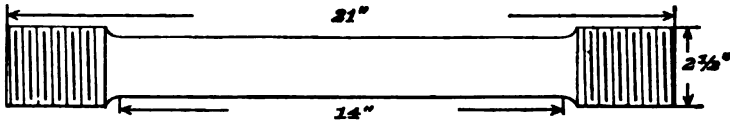
Contraction of area, 18.6 per cent.

Appearance of fracture, uniform light yellow color.

Composition	{	Copper .....	87.00
		Tin .....	7.78
		Zinc .....	4.85

BRONZE FROM NEW YORK NAVY-YARD.

Form of specimens.



No. 5765.

Marks, A<sub>1</sub>.  
 Diameter, 1".875.  
 Sectional area, 2".76 square inches.  
 Gauged length, 10".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
2,760	1,000	0.	0.	0.	0.	
5,520	2,000	.00010	.00010			Elastic limit.
8,280	3,000	.00019	.00009			
11,040	4,000	.00029	.00010			
13,800	5,000	.00039	.00010	.00003	.00003	
16,560	6,000	.00050	.00011			
19,320	7,000	.00060	.00010			
22,080	8,000	.00073	.00013			
24,840	9,000	.00089	.00016			
27,600	10,000	.00111	.00022	.00027	.00024	
30,360	11,000	.00151	.00040			
33,120	12,000	.00210	.00059			
35,880	13,000	.00367	.00157			
38,640	14,000	.00660	.00293			
41,400	15,000	.01436	.00776			
44,160	16,000	.021	.00664			
46,920	17,000	.030	.009			Cracks open in surface of stem.
49,680	18,000					Tensile strength.

General summary.

Tensile strength per square inch of original section.....	pounds..	18,000
Elastic limit per square inch of original section.....	do..	7,000
Elongation per inch after rupture.....	inch..	.043
Elongation per inch under strain at elastic limit.....	do..	.00000
Reduction in diameter at point of rupture.....	do..	.005
Reduction in area after rupture, per cent of original section.....		6.9
Character of broken surface.....	vesicular, the color varying from light to dark yellow	
Elongation of inch sections..".06,".04,".05,".05,".12,".05,".04,".03,".03,".03,".04,".03,".02,".01		
Composition.....	{	
	Copper.....	87.00
	Tin.....	10.24
	Zinc.....	2.03

No. 5766.

Marks, A<sub>3</sub>.

Diameter, 1".875.

Sectional area, 2.76 square inches.

Gauged length, 10".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
2, 760	1, 000	0.	0.	0.	0.	
5, 520	2, 000	.00011	.00011	.....	.....	Elastic limit.
8, 280	3, 000	.00022	.00011	.....	.....	
11, 040	4, 000	.00032	.00010	.....	.....	
13, 800	5, 000	.00043	.00011	.00003	.00003	
16, 560	6, 000	.00054	.00011	.....	.....	
19, 320	7, 000	.00066	.00012	.....	.....	
22, 080	8, 000	.00081	.00015	.....	.....	
24, 840	9, 000	.00103	.00022	.....	.....	
27, 600	10, 000	.00139	.00036	.00045	.00042	
30, 360	11, 000	.00204	.00065	.....	.....	
33, 120	12, 000	.00344	.00140	.....	.....	
35, 880	13, 000	.00642	.00298	.....	.....	
38, 640	14, 000	.01110	.00468	.....	.....	
41, 400	15, 000	.01910	.00890	.01745	.01700	
44, 160	16, 000	.029	.....	.....	.....	Tensile strength.
46, 700	16, 920	.....	.....	.....	.....	

*General summary.*

Tensile strength per square inch of original section .....	pounds..	16, 920
Elastic limit per square inch of original section .....	do..	7, 600
Elongation per inch after rupture, in 14 inches .....	inch..	.034
Elongation per inch under strain at elastic limit .....	do..	.00066
Reduction in diameter at point of rupture .....	do..	.035
Reduction in area after rupture, per cent of original section .....	do..	3.6
Position of rupture .....	at neck	
Character of broken surface .....	irregular, varying in color from light to dark yellow	
Elongation of inch sections .....	".04, ".01, ".03, ".03, ".02, ".05, ".02, ".04, ".03, ".04, ".03, ".03, ".04, ".05	

No. 5767.

Marks, B.

Diameter, 1."875.

Sectional area, 2.76 square inches.

Gauged length, 10".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
2,760	1,000	0.	0.	0.	0.	
5,520	2,000	.00011	.00011			
8,280	3,000	.00021	.00010			
11,040	4,000	.00031	.00010			
13,800	5,000	.00041	.00010	.00002	.00002	
16,560	6,000	.00052	.00011			
19,320	7,000	.00062	.00010			
22,080	8,000	.00074	.00012			
24,840	9,000	.00090	.00016			
27,600	10,000	.00110	.00020	.00022	.00020	
30,360	11,000	.00151	.00041			
33,120	12,000	.00253	.00102			
35,880	13,000	.00395	.00142			
38,640	14,000	.00710	.00315			
41,400	15,000	.01250	.00540	.01101	.01079	
43,800	15,870					Tensile strength.

*General summary.*

Tensile strength per square inch of original section.....	pounds..	15.870
Elastic limit per square inch of original section.....	do...	8.000
Elongation per inch after rupture, in 14 inches.....	inch...	.010
Elongation per inch under strain at elastic limit.....	do...	.00074
Reduction in diameter at point of rupture.....		inappreciable
Character of broken surface.....		irregular, color variable, light lavender to copper colored
Elongation of inch sections... " .02, " .01, " .01, " .02, " .00, " .01, " .01, " .02, " .01, " .00, " .01, " .01, " .01, " .00		
Composition.....	{ Copper.....	86.98
	{ Tin.....	9.00
	{ Zinc.....	4.02



No. 5768.

Marks, C.

Diameter, 1".875.

Sectional area, 2.76 square inches.

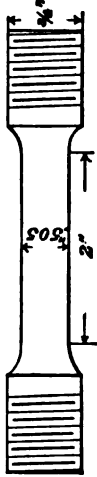
Gauged length, 10".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
2,760	1,000	0.	0.	0.	0	Initial load.
5,520	2,000	.00010	.00010			
8,280	3,000	.00020	.00010			
11,040	4,000	.00030	.00010			
13,800	5,000	.00040	.00010	.00003	.00003	
16,560	6,000	.00052	.00012			Elastic limit.
19,320	7,000	.00067	.00015			
22,080	8,000	.00080	.00023			
24,840	9,000	.00140	.00050			
27,600	10,000	.00294	.00154	.00213	.00210	
30,360	11,000	.00643	.00349			
33,120	12,000	.01535	.00892			
35,880	13,000	.025	.00965			
38,640	14,000	.034	.009			
41,400	15,000	.048	.012			
44,160	16,000	.058	.012			
46,920	17,000	.070	.012			
49,680	18,000	.084	.014			
52,440	19,000	.100	.016			
55,200	20,000	.118	.016			
57,700	20,900	.133	.017			Tensile strength.

*General summary.*

Tensile strength per square inch of original section.....	pounds..	20,900
Elastic limit per square inch of original section.....	do.	6,000
Elongation per inch after rupture, in 14 inches.....	inch.	.138
Elongation per inch under strain at elastic limit.....	do.	.00052
Reduction in diameter at point of rupture.....	do.	.195
Reduction in area after rupture, per cent of original section.....	do.	19.6
Character of broken surface.....	irregular, copper-colored and brown. Numerous cracks developed in the surface of stem.	
Elongation of inch sections.....	"14, "13, "12, "13, "14, "12, "14, "27, "14, "14, "10, "11, "13	
Composition.....	{ Copper	94.46
	{ Tin	4.91

Specimens from steel forgings for 8-inch B. L. rifle barbette carriage.

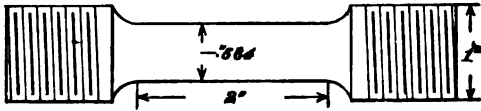


No. of test.	Mark on specimen.	Diam. eter.	Sectional area.	Elastic limit.		Ultimate strength.		Elongation in 2 inches.		Area at fracture.	Con- traction of area.	Appearance of fracture.
				Total.	Per square inch.	Total.	Per square inch.	Inch.	Per ct.			
5720	W <sub>A</sub> , In. T <sub>1</sub> ...	.505	Sq. in. .28	Pounds. 9,520	Pounds. 49,150	Pounds. 18,300	Pounds. 91,800	Inch. .44	Per ct. 22.5	Diam., .41=	Per ct. 34.0	Silky, trace of granulation.
5721	W <sub>A</sub> , In. L <sub>1</sub> ...	.505	.20	9,790	48,850	14,210	71,050	.65	82.5	Diam., .38=	57.2	Fine silky.
5722	W <sub>A</sub> , In. L <sub>2</sub> ...	.505	.20	10,570	54,350	15,890	74,800	.63	81.5	Diam., .38=	51.9	Do.
5723	W <sub>A</sub> , In. L <sub>3</sub> ...	.505	.20	11,150	55,750	15,820	84,100	.47	22.5	Diam., .38=	43.3	Do.
5724	W <sub>A</sub> , In. L <sub>1</sub> ...	.505	.20	8,400	42,000	13,410	67,050	.05	2.5	Diam., .505=	16.9	Granular, flaky streak.
5724a	W <sub>A</sub> , In. L <sub>2</sub> ...	.505	.20	9,520	47,000	13,110	90,550	.34	17.0	Diam., .46=	16.9	Granular, flaky spot at circumference. Opened minute cracks in vicinity of rupture.
5725	W <sub>A</sub> , In. T <sub>1</sub> M.	.505	.20	9,970	49,850	17,990	89,050	.92	16.0	Diam., .45=	20.5	Granular, dull spot at circumference.
5726	W <sub>A</sub> , In. L <sub>1</sub> ...	.505	.20	8,780	43,900	16,770	83,850	.15	7.5	Diam., .48=	9.5	Granular.
5727	W <sub>A</sub> , In. T <sub>1</sub> M.	.505	.20	9,510	47,550	18,150	90,750	.42	21.0	Diam., .42=	30.7	Silky, granular at circumference.
5728	W <sub>A</sub> , S <sub>Q</sub> L <sub>1</sub> ...	.505	.20	11,750	58,750	18,220	91,100	.49	24.5	Diam., .37=	46.2	Fine silky.
5729	W <sub>A</sub> , S <sub>H</sub> L <sub>1</sub> A	.505	.20	12,150	60,750	18,370	91,850	.53	26.5	Diam., .38=	49.1	Fine silky.
5730	W <sub>A</sub> , S <sub>H</sub> L <sub>1</sub> C	.505	.20	9,500	47,500	19,060	95,300	.46	23.0	Diam., .40=	37.1	Silky.
5731	W <sub>A</sub> , S <sub>H</sub> L <sub>1</sub> A	.505	.20	11,020	56,100	17,840	89,200	.57	28.5	Diam., .34=	54.6	Fine silky.
5732	W <sub>A</sub> , S <sub>H</sub> L <sub>1</sub> C	.505	.20	10,980	54,900	18,800	94,000	.48	24.0	Diam., .37=	46.2	Do.

\* Inappreciable.

No. 5707.

Material for nuts for 8" B. L. rifle barbette carriage.



Sectional area, .25 square inch.

Elastic limit, 10,980 pounds=43,920 pounds per square inch.

Tensile strength, 14,770 pounds=59,080 pounds per square inch.

Elongation in 2 inches, ".76=38 per cent.

Elongation of inch sections, ".48\* ".28.

Diameter at fracture, ".35. Area, .0962 square inch.

Contraction of area, 61.5 per cent.

Appearance of fracture, fine silky.

H. Ex. 43—22

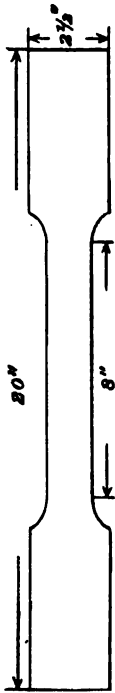
STEEL PLATE FOR 8" B. L. RIFLE BARBETTE CARRIAGE.



No. of test.	Mark on speci-men.	Dimensions in inches.		Sec-tional area.	Elastic limit.		Ultimate strength.		Elongation in 10 inches.		Area at fracture.	Con-traction of area.	Appearance of fracture.	Elongation of inch sections.
		Width.	Thick-ness.		Total.	Per square inch.	Total.	Per square inch.	Inches.	Per ct.				
5708	1	.998	.490	Sq. in. .489	Pounds. 17,700	Pounds. 26,970	Pounds. 55,150	Inches. 2.54	Per ct. 25.4	In. In. Sq. in. .66 $\times$ .25 = .165	Per ct. 66.2	Silky .....	.15, .15, .18, .19, .19, .25, .21, .70*	.24
5709	2	.994	.487	.484	16,520	26,990	55,760	2.58	25.8	.65 $\times$ .27 = .175	63.8	do .....	.72, .28, .22, .20, .21, .22, .21, .16, .18, .18	.18, .18
5710	3	.994	.496	.493	16,680	29,590	60,920	2.70	27.0	.68 $\times$ .28 = .190	61.5	do .....	.35, .59*, .25, .26, .24, .21, .17, .18, .24, .23	.24, .23
5711	4	.994	.499	.496	17,850	29,890	60,240	2.10	21.0	.68 $\times$ .28 = .193	61.1	do .....	.17, .15, .16, .15, .16, .15, .16, .15, .24, .62*	.24, .62*
5712	5	.996	.412	.410	16,300	23,120	56,390	2.49	24.9	.73 $\times$ .23 = .168	59.0	do .....	.20, .17, .19, .20, .20, .19, .32, .55*, .25, .23	.25, .23
5713	6	.993	.373	.370	14,930	20,660	55,840	2.02	20.2	.75 $\times$ .20 = .150	59.5	do .....	.60*, .21, .21, .19, .14, .14, .17, .14, .11, .11	.11, .11
5714	7	.995	.241	.240	9,760	14,490	60,080	2.16	21.6	.75 $\times$ .14 = .105	56.2	Silky, lamel-lar.	.22, .19, .16, .13, .15, .18, .25, .52*, .19, .17	.19, .17

TENSILE TESTS OF STEEL PLATES FROM THE SPRINGFIELD ARMORY, REPRESENTING METAL FOR 3.2-INCH FIELD GUN CARRIAGES.

Form of specimens.



No. of test.	Mark on spec-imen.	Dimensions in inches.		Sec-tional area.	Elastic limit.		Ultimate strength.		Elongation in 8 inches.	Area at fracture.	Con-traction of area.	Appearance of fracture.	Flongation of luch sections.
		Width.	Thick-ness.		Total.	Per square inch.	Total.	Per square inch.					
5606	109	1.521	.192	.292	Pounds.	Pounds.	Pounds.	Pr. ct.	In.	Inches Sq. in.	Pr. ct.	SILKY	"
5607	110	1.533	.205	.314	15,800	54,100	22,160	75,890	1.66	1.24 x .18 = 161	44.9	"	"
5608	111	1.521	.212	.322	17,190	54,710	24,540	78,150	1.70	1.26 x .13 = 164	47.8	"	"
5609	112	1.525	.213	.325	17,300	53,730	25,290	78,540	1.65	1.24 x .15 = 186	42.2	"	"
5610	113	1.523	.205	.312	17,980	55,320	25,240	77,660	1.75	1.23 x .15 = 184	43.4	"	"
5611	114	1.531	.203	.312	16,710	53,560	23,970	76,830	1.72	1.23 x .13 = 161	48.4	"	"
5612	115	1.518	.206	.312	16,850	54,500	24,060	77,360	1.82	1.24 x .14 = 174	44.1	"	"
5613	116	1.519	.208	.316	16,810	53,910	23,950	76,780	1.75	1.21 x .15 = 180	40.4	"	"
5614	117	1.515	.204	.309	17,950	58,090	24,220	78,650	1.88	1.23 x .16 = 195	38.3	"	"
5615	118	1.538	.207	.318	17,810	56,010	23,780	74,810	1.52	1.26 x .13 = 164	46.9	"	"
5616	119	1.530	.204	.312	Indehmite	Indehmite	40,530	129,900	.82	1.43 x .16 = 229	26.6	"	"
5617	120	1.527	.196	.299	16,840	56,320	23,310	77,960	1.60	1.23 x .13 = 160	46.5	"	"
5618	121	1.533	.204	.313	17,400	55,590	24,510	78,310	1.60	1.27 x .14 = 178	43.1	"	"
5619	122	1.520	.194	.295	16,650	56,440	22,190	75,220	1.65	1.26 x .14 = 176	40.3	"	"
5620	123	1.523	.196	.299	17,800	59,530	23,310	77,960	1.67	1.25 x .13 = 162	45.8	"	"
5621	124	1.521	.198	.298	16,690	56,010	23,240	77,980	1.65	1.27 x .12 = 158	49.0	"	"
5622	125	1.525	.204	.311	17,570	56,500	24,270	78,040	1.75	1.22 x .14 = 171	45.0	"	"
5623	126	1.525	.200	.305	17,260	56,590	22,810	74,790	1.65	1.23 x .15 = 184	39.7	"	"
5624	127	1.516	.198	.298	16,950	53,420	21,200	76,870	1.64	1.23 x .13 = 160	46.7	"	"
5625	128	1.522	.196	.298	16,510	53,600	22,910	76,880	1.75	1.23 x .13 = 160	46.3	"	"
5626	129	1.542	.200	.308	15,970	53,960	23,430	78,040	1.92	1.26 x .12 = 155	48.1	"	"
5627	130	1.525	.196	.291	15,970	53,960	21,680	73,120	1.60	1.26 x .12 = 155	48.5	"	"
5628	131	1.522	.191	.293	15,940	54,400	21,430	73,140	1.64	1.26 x .13 = 164	44.0	"	"
5629	132	1.530	.194	.297	17,020	57,310	23,190	78,060	1.68	1.26 x .15 = 189	36.4	"	"

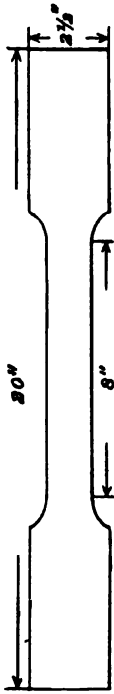
STEEL PLATE FOR 8" B. L. RIFLE BARBETTE CARRIAGE.



No. of test.	Dimensions in inches.		Sec. tional area.	Elastic limit.		Ultimate strength.		Elongation in 10 inches.	Area at fracture.	Con- traction of area.	Appearance of fracture.	Elongation of inch sections.
	Width.	Thick- ness.		Total.	Per square inch.	Total.	Per square inch.					
5708	.988	.490	Sq. in. .469	Pounds. 17,700	Pounds. 55,150	Inches. 2.54	Pr. ct. 66.2	.66 X .25 = .165	Fr. ct. 66.2	Silky	.15, .15, .18, .19, .19, .25, .21, .70*, .28, .24	
5709	.984	.487	.484	16,520	55,760	2.58	25.8	.66 X .27 = .175	63.8	.00	.72, .28, .22, .20, .21, .22, .21, .16, .16, .18	
5710	.986	.486	.483	16,680	60,020	2.70	27.0	.68 X .28 = .190	61.5	.00	.36, .59*, .25, .25, .24, .21, .17, .18, .24, .22	
5711	.984	.499	.496	17,850	60,240	2.10	21.0	.69 X .28 = .193	61.1	.00	.17, .15, .16, .16, .16, .16, .16, .18, .22, .62*	
5712	.988	.412	.410	16,300	56,880	2.49	24.9	.73 X .23 = .168	59.0	.00	.20, .17, .19, .20, .20, .19, .32, .56*, .25, .22	
5713	.983	.373	.370	14,930	56,840	2.02	20.2	.75 X .20 = .150	59.5	.00	.60*, .21, .21, .19, .14, .14, .17, .14, .11, .11	
5714	.985	.241	.240	9,760	60,060	2.16	21.6	.75 X .14 = .105	56.2	Silky, lamel- lar.	.22, .19, .16, .13, .15, .18, .25, .52*, .19, .17	

TENSILE TESTS OF STEEL PLATES FROM THE SPRINGFIELD ARMOY, REPRESENTING METAL FOR 3.2-INCH FIELD GUN CARRIAGES.

Form of specimens.



No. of test.	Mark on spec-imen.	Dimensions in inches.		Sec- tional area.	Elastic limit.		Ultimate strength.		Elongation in 8 inches.	Area at fracture.	Con- traction of area.	Appearance of fracture.	Flongation of inch sections.
		Width.	Thick- ness.		Total.	Per square inch.	Total.	Per square inch.					
5606	109	1.521	.192	Sq. in. .292	Pounds. 15,800	Pounds. 22,160	Pounds. 75,890	In. 1.66	Pr. et. 20.8	Inches Sq. in. 1.24 x .13 = 161	Pr. et. 47.8	SILKY	" 14, 18, 23, 45*, 20, 18, 16, 12
5607	110	1.533	.205	.314	17,180	24,540	78,150	1.70	21.1	1.26 x .13 = 164	44.9	do	" 16, 27, 47*, 20, 18, 15, 15, 12
5608	111	1.521	.212	.322	17,300	25,730	78,540	1.65	20.6	1.24 x .15 = 186	42.2	do	" 12, 13, 15, 18, 22, 30, 40*, 15, 15
5609	112	1.525	.213	.325	17,080	25,320	77,660	1.75	21.9	1.23 x .15 = 184	43.4	do	" 12, 16, 17, 20, 50*, 20, 15, 10
5610	113	1.522	.205	.312	16,710	23,560	76,830	1.72	21.5	1.24 x .13 = 161	48.4	do	" 18, 53*, 22, 18, 18, 17, 17, 10
5611	114	1.531	.206	.311	16,950	24,060	77,360	1.82	22.8	1.24 x .14 = 174	44.4	do	" 20, 48*, 20, 20, 19, 21, 19, 15
5612	115	1.516	.208	.312	16,810	23,950	76,760	1.88	23.5	1.23 x .15 = 180	38.3	do	" 18, 32*, 32*, 20, 18, 20, 14, 18
5613	116	1.519	.208	.316	16,810	24,020	77,860	1.96	23.8	1.22 x .13 = 164	46.9	do	" 16, 50*, 27, 23, 17, 18, 18, 18
5614	117	1.515	.204	.309	17,950	26,060	81,900	1.52	19.0	1.26 x .13 = 164	44.7	do	" 12, 16, 22, 48*, 24, 15, 10, 13, 12, 12
5615	118	1.536	.207	.318	17,810	23,760	74,810	1.52	19.0	1.26 x .14 = 176	44.7	do	" 18, 48*, 24, 15, 10, 13, 12, 12
5616	119	1.530	.204	.312	Indefinite	40,530	129,900	.82	10.3	1.43 x .16 = 229	26.6	SILKY, interspersed with fine granulation.	" 08, .04, .06, .10, .08, .12, 24, .06
5617	120	1.527	.196	.299	16,840	26,320	77,960	1.60	20.0	1.27 x .13 = 160	46.5	SILKY	" 12, 16, 20, 44*, 13, 17, 16, 12
5618	121	1.533	.204	.313	17,400	24,510	78,310	1.60	20.0	1.27 x .14 = 178	43.3	do	" 15, 23, 44*, 16, 12, 16, 14, 20
5619	122	1.520	.194	.296	16,650	26,440	75,220	1.65	20.6	1.26 x .14 = 176	40.3	do	" 12, 16, 12, 20, 48*, 22, 20, 15
5620	123	1.523	.196	.299	17,800	23,310	77,990	1.67	20.9	1.27 x .13 = 162	45.8	do	" 18, 47*, 25, 18, 17, 15, 16, 11
5621	124	1.521	.196	.298	16,690	23,240	77,990	1.65	20.9	1.27 x .12 = 152	49.0	do	" 15, 30, 47*, 23, 20, 17, 13, 10
5622	125	1.525	.204	.311	17,570	24,270	78,040	1.75	21.9	1.23 x .14 = 171	45.0	do	" 12, 16, 20, 17, 23, 47*, 20, 15
5623	126	1.525	.200	.305	17,280	26,590	79,070	1.65	20.6	1.23 x .15 = 184	39.7	do	" 18, 47*, 20, 15, 15, 17, 18, 15
5624	127	1.516	.198	.298	16,050	23,420	76,800	1.75	21.9	1.23 x .13 = 160	46.3	do	" 16, 34, 40*, 18, 14, 16, 12, 14
5625	128	1.522	.198	.298	16,510	23,600	76,800	1.92	24.0	1.23 x .13 = 160	48.1	do	" 18, 22, 49*, 17, 14, 18, 20, 17
5626	129	1.542	.200	.308	15,940	23,400	76,400	1.80	22.5	1.26 x .12 = 155	48.5	do	" 15, 22, 50*, 23, 20, 21, 22, 17
5627	130	1.535	.196	.293	15,940	21,960	73,140	1.64	20.5	1.26 x .13 = 164	44.0	do	" 12, 16, 14, 18, 45*, 25, 20, 15
5628	131	1.533	.194	.293	15,940	21,430	73,140	1.60	20.5	1.26 x .13 = 164	44.0	do	" 12, 16, 14, 18, 45*, 25, 20, 14
5629	132	1.530	.194	.297	17,020	23,190	78,080	1.68	21.0	1.26 x .15 = 189	36.4	do	" 13, 13, 34*, 34*, 16, 18, 17, 13

STEEL PLATE FOR 8" B. L. RIFLE BARBETTE CARRIAGE.

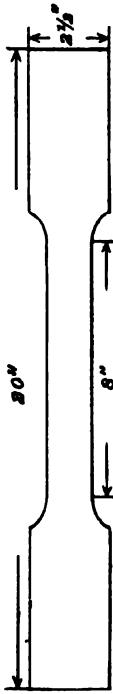


No. of test.	Mark on specimen.	Dimensions in inches.		Sec-tional area.	Elastic limit.		Ultimate strength.		Elongation in 10 inches.		Area at fracture.	Con-traction of area.	Appearance of fracture.	Elongation of inch sections.
		Width.	Thick-ness.		Total.	Per square inch.	Total.	Per square inch.	Inches.	Per ct.				
5708	1	.998	.490	Sq. in. 489	Pounds. 17,700	Pounds. 36,190	Pounds. 26,970	55,150	2.54	25.4	In. X. Sq. in. 68 X 25 = 165	66.2	Silky	15, 15, 18, 19, 19, 25, 21, 70*, 28, 24
5709	2	.994	.487	484	16,520	34,130	26,990	53,760	2.58	25.8	68 X 27 = 175	63.8	do	72, 28, 22, 20, 21, 22, 21, 18, 15, 18
5710	3	.994	.496	492	18,680	33,830	29,590	60,020	2.70	27.0	68 X 29 = 190	61.3	do	36, 59, 25, 25, 24, 21, 17, 18, 24, 22
5711	4	.994	.499	496	17,850	35,990	28,890	60,240	2.10	21.0	68 X 28 = 183	61.7	do	17, 15, 16, 15, 16, 15, 15, 15, 28, 26*
5712	5	.996	.412	410	16,300	30,760	23,130	53,690	2.19	21.9	73 X 29 = 188	59.9	do	29, 17, 19, 26, 26, 19, 23, 15, 25, 22
5713	6	.993	.373	370	14,930	40,350	20,660	53,840	2.02	20.2	75 X 29 = 189	59.5	do	60, 21, 21, 19, 14, 18, 17, 14, 11, 11
5714	7	.996	.241	240	9,760	40,670	14,420	60,080	2.10	21.6	75 X 24 = 108	56.2	Silky, lamel-lar.	22, 19, 16, 13, 16, 16, 25, 52, 19, 17



TENSILE TESTS OF STEEL PLATES FROM THE SPRINGFIELD ARMORY, REPRESENTING METAL FOR 3.2-INCH FIELD GUN CARRIAGES.

Form of specimens.



No. of test.	Mark on specimens.	Dimensions in inches.		Sec. tional area.	Elastic limit.		Ultimate strength.		Elongation in 8 inches.	Area at fracture.	Con. traction of area.	Appearance of fracture.	Elongation of inch sections.
		Width.	Thick. ness.		Total.	Per square inch.	Total.	Per square inch.					
5606	109	1.531	.192	Pounds. 15,800	Pounds. 54,100	Pounds. 22,160	Pounds. 75,800	<i>Pr. et.</i> 1.66	<i>In.</i> 20.8	<i>Inches</i> 1.24 x .13 = .161	<i>Pr. et.</i> 44.9	Silky	14, 18, 23, 45*, 20, 18, 16, 12
5607	110	1.533	.205	17,180	54,710	24,540	78,150	1.70	21.1	1.26 x .13 = .164	47.8	do	16, 27, 47*, 20, 18, 15, 16, 12
5608	111	1.531	.212	17,300	53,730	25,230	78,540	1.65	20.6	1.28 x .15 = .196	42.2	do	12, 13, 15, 18, 22, 30, 40*
5609	112	1.525	.213	17,960	56,320	25,240	77,660	1.75	21.9	1.23 x .15 = .184	43.4	do	12, 16, 17, 20, 50*, 25, 20, 15
5610	113	1.522	.205	16,710	53,560	23,970	76,830	1.72	21.5	1.24 x .13 = .161	48.4	do	18, 32*, 22, 18, 18, 17, 17, 10
5611	114	1.531	.203	16,050	54,500	24,060	77,360	1.82	22.5	1.24 x .14 = .174	44.1	do	20, 48*, 20, 20, 19, 21, 19, 15
5612	115	1.516	.206	16,820	53,910	23,950	76,760	1.72	21.5	1.23 x .15 = .186	40.4	do	18, 32*, 32*, 20, 18, 18, 20, 14
5613	116	1.519	.208	16,810	53,200	24,220	76,650	1.90	23.8	1.25 x .16 = .195	38.3	do	18, 50*, 27, 23, 17, 17, 18, 18
5614	117	1.513	.204	16,900	56,060	24,090	77,860	1.84	23.5	1.23 x .13 = .164	44.9	do	12, 16, 22, 48*, 26, 32, 22, 12
5615	118	1.536	.207	17,810	56,010	23,790	74,810	1.52	19.0	1.26 x .14 = .176	44.7	do	18, 48*, 24, 15, 10, 18, 12, 12
5616	119	1.530	.204	Indefinite	40,530	129,900		.82	10.3	1.43 x .16 = .229	26.6	Silky, interspersed with fine granulation.	08, .04, .08, 10, .08, .12, 26, .06
5617	120	1.527	.196	16,840	56,320	23,310	77,960	1.60	20.0	1.27 x .13 = .160	46.5	Silky	12, 16, 20, 44*, 18, 17, 16, 12
5618	121	1.533	.204	17,400	55,590	24,510	78,310	1.60	20.0	1.23 x .14 = .178	43.1	do	15, 23, 44, 16, 12, 16, 14, 20
5619	122	1.520	.194	16,650	56,440	22,190	75,220	1.65	20.6	1.26 x .14 = .176	40.3	do	12, 16, 12, 20, 48*, 22, 20, 15
5620	123	1.523	.196	17,800	56,530	23,310	77,960	1.67	20.9	1.25 x .13 = .162	45.8	do	18, 47*, 25, 18, 17, 15, 16, 11
5621	124	1.521	.196	16,690	56,010	23,240	77,980	1.65	20.6	1.27 x .12 = .152	49.0	do	15, 20, 47*, 22, 20, 17, 13, 10
5622	125	1.525	.204	17,570	56,500	23,270	78,040	1.75	21.9	1.22 x .14 = .171	45.0	do	12, 16, 20, 17, 28, 47*, 20, 15
5623	126	1.526	.200	17,260	56,560	22,810	74,790	1.65	20.5	1.23 x .15 = .184	39.7	do	18, 47*, 20, 15, 15, 17, 12, 15
5624	127	1.516	.198	16,060	53,420	20,700	70,670	1.64	20.5	1.25 x .13 = .160	46.7	do	16, 34, 40*, 18, 14, 16, 12, 14
5625	128	1.522	.196	16,920	53,420	22,910	76,890	1.75	21.9	1.23 x .13 = .160	46.3	do	18, 49*, 17, 14, 18, 20, 17
5626	129	1.542	.200	16,510	53,900	23,420	76,640	1.92	24.0	1.26 x .13 = .160	48.1	do	18, 22, 50*, 22, 20, 21, 22, 17
5627	130	1.535	.191	15,970	53,060	21,960	73,140	1.80	22.5	1.29 x .12 = .155	48.5	do	15, 15, 20, 25, 48*, 25, 20, 15
5628	131	1.532	.196	15,940	54,400	21,430	73,160	1.64	20.5	1.26 x .13 = .164	44.0	do	12, 16, 14, 18, 45*, 26, 20, 14
5629	132	1.530	.194	17,020	57,310	23,190	78,080	1.68	21.0	1.26 x .15 = .189	36.4	do	13, 18, 34*, 34*, 16, 18, 17, 17

TENSILE TESTS OF STEEL PLATES FROM THE SPRINGFIELD ARMORY, REPRESENTING METAL FOR 3.2-INCH FIELD GUN CARRIAGES—Continued.

No. of test.	Dimensions in inches.		Sectional area. Sq. in.	Elastic limit.		Ultimate strength.		Elongation in 8 inches.		Area at fracture. Inches Sq. in.	Contraction of area. Pr. ct.	Appearance of fracture.	Elongation of inch sections.	
	Width.	Thick. ness.		Total. Pounds.	Per square inch.	Total. Pounds.	Per square inch.	In.	Pr. ct.				"	"
5630	1.523	.194	17,100	57,970	22,970	77,980	1.65	20.9	1.28 × 12 = 184	Pr. ct.	Silly	15	17	
5631	1.520	.193	17,360	59,210	23,100	77,840	1.62	20.3	1.28 × 12 = 184	44.1	do	18	14	
5632	1.513	.192	17,600	60,480	23,510	77,540	1.62	20.3	1.24 × 12 = 149	43.8	do	20	18	
5633	1.517	.190	17,990	62,860	22,440	77,480	1.64	20.5	1.24 × 12 = 171	43.7	do	14	23	
5634	1.517	.190	18,300	65,860	24,410	80,830	1.64	20.5	1.26 × 13 = 184	45.7	do	17	16	
5635	1.525	.193	18,400	68,610	25,110	82,330	1.65	20.6	1.25 × 13 = 161	46.2	do	12	15	
5636	1.520	.198	18,650	70,310	22,710	75,450	1.60	20.0	1.25 × 13 = 162	45.2	do	15	18	
5637	1.520	.204	18,700	71,520	24,250	80,650	1.60	20.0	1.27 × 14 = 172	45.2	do	12	16	
5638	1.522	.202	18,810	71,270	24,510	79,840	1.68	21.0	1.27 × 13 = 165	47.9	do	14	21	
5639	1.527	.200	19,000	73,820	24,980	81,960	1.62	20.3	1.26 × 14 = 176	46.3	do	15	15	
5640	1.526	.203	19,440	75,730	25,060	81,860	1.61	20.1	1.24 × 14 = 169	43.7	do	12	16	
5641	1.521	.197	19,620	78,300	23,490	78,200	1.70	21.3	1.21 × 14 = 173	43.1	do	12	13	
5642	1.521	.200	19,800	82,060	25,060	81,960	1.58	19.8	1.23 × 14 = 169	43.7	do	15	19	
5643	1.516	.201	19,800	82,060	25,060	81,960	1.58	19.8	1.23 × 13 = 159	43.6	do	12	12	
5644	1.517	.197	20,000	85,870	23,710	77,740	1.72	21.5	1.22 × 14 = 172	43.6	do	14	16	
5645	1.525	.200	19,800	82,260	25,040	81,910	1.60	20.0	1.22 × 13 = 159	46.9	do	14	16	
5646	1.529	.197	18,200	60,470	23,860	78,000	1.65	20.6	1.27 × 14 = 178	46.9	do	12	12	
5647	1.528	.197	18,370	62,370	23,960	78,600	1.65	20.6	1.23 × 14 = 172	42.9	do	16	18	
5648	1.528	.196	18,580	62,140	23,690	78,200	1.60	20.0	1.28 × 12 = 154	48.5	do	15	15	
5649	1.534	.194	18,970	62,810	24,638	81,560	1.61	20.1	1.28 × 12 = 154	49.0	do	14	18	
5650	1.526	.205	17,400	58,780	22,910	77,400	1.61	20.1	1.27 × 12 = 152	48.6	do	16	16	
5651	1.528	.205	18,600	69,420	24,620	78,660	1.65	16.9	1.24 × 15 = 186	40.6	do	15	20	
5652	1.526	.194	18,900	68,140	24,710	78,980	1.65	19.4	1.26 × 14 = 175	40.7	do	14	21	
5653	1.521	.196	18,100	60,380	23,740	79,180	1.78	22.3	1.26 × 13 = 160	46.7	do	13	12	
5654	1.519	.198	18,430	61,200	25,060	79,670	1.72	21.5	1.26 × 13 = 160	46.7	do	12	13	
5655	1.519	.198	18,430	61,200	25,060	79,670	1.72	21.5	1.26 × 12 = 151	49.8	do	15	20	

**CHEMICAL COMPOSITION OF STEEL PLATES FROM THE SPRINGFIELD ARMORY, REPRESENTING METAL FOR 3.2-INCH FIELD GUN CARRIAGES.**

Tension test number.	Marks.	Carbon.			Manganese.	Silicon.	Sulphur.	Phosphorus.	Copper.	Remarks.
		Total.	Graphitic.	Combined.						
5423	78	.....	.....	0.261	1.848	0.033	.....	.....	.....	} Tension tests of these specimens published in Report of Tests, 1891.
5425	80	.....	.....	0.218	1.200	0.021	.....	.....	.....	
5428	81	.....	.....	0.217	1.130	0.035	.....	.....	.....	
5440	85	.....	.....	0.187	1.180	0.030	.....	.....	.....	
5442	97	.....	.....	0.290	2.128	0.032	.....	.....	.....	
5443	98	.....	.....	0.200	1.142	0.030	.....	.....	.....	
5447	102	.....	.....	0.150	0.896	0.034	.....	.....	.....	
5612	115	0.170	0.010	0.160	.....	0.038	0.1.3	0.034	.....	
5616	119	0.400	0.011	0.389	.....	0.101	0.103	0.058	.....	

STEEL FROM PISTON ROD FOR 12-INCH MORTAR CARRIAGE.

No. 4571.

Marks, P B, B. L.

Diameter, ".500.

Sectional area, .196 square inch.

Gauged length, 2".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.	
196	1,000	0.	0.	0.	.0	Initial load.
980	5,000	.000100	.000100	0.	.....	
1,960	10,000	.000350	.000250	.....	.....	
2,940	15,000	.000500	.000150	.....	.....	
3,920	20,000	.000600	.000100	.....	.....	
4,900	25,000	.000850	.000250	0.	.....	
5,880	30,000	.000950	.000100	.....	.....	
6,860	35,000	.001100	.000100	.....	.....	
7,840	40,000	.001200	.000100	0.	.....	
8,820	45,000	.001350	.000150	.....	.....	
9,800	50,000	.001550	.000200	0.	.....	Elastic limit.
9,996	51,000	.009700	.008150	.....	.....	
10,192	52,000	.010050	.000350	.....	.....	
10,388	53,000	.010400	.000350	.....	.....	
10,584	54,000	.011250	.000850	.....	.....	
10,780	55,000	.012500	.001250	.....	.....	Tensile strength.
18,110	92,400	.....	.....	.....	.....	

General summary.

Tensile strength per square inch of original section .....	pounds..	92,400
Elastic limit per square inch of original section .....	do..	50,000
Elongation per inch after rupture .....	inch..	.210
Elongation per inch under strain at elastic limit .....	do..	.001550
Reduction in diameter at point of rupture .....	do..	.090
Reduction in area after rupture, per cent of original section .....		32.6
Position of rupture .....	" 9 from neck	
Character of broken surface .....	silky	
Elongation of inch sections .....	" 26", " 16	

No. 4572.

Marks, P R<sub>1</sub> M L<sub>2</sub>

Diameter, ".500.

Sectional area, 196 square inches.

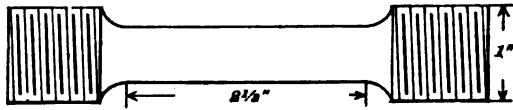
Gauged length, 2".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
196	1,000	.0	.0	.0	.0	
980	5,000	.000100	.000100	.0	.0	
1,960	10,000	.000200	.000200			
2,940	15,000	.000350	.000150			
3,920	20,000	.000600	.000250			
4,900	25,000	.000850	.000250			
5,880	30,000	.001100	.000250	.000050	.000050	
6,860	35,000	.001300	.000200	.000050	.0	
7,840	40,000	.001500	.000200			
8,820	45,000	.001650	.000050			
9,808	48,000	.001800	.000150			
9,804	48,000	.001850	.000050			
9,800	50,000	.003250	.001400			
9,996	51,000	.012750	.008500			
10,192	52,000	.013250	.006500			
10,388	53,000	.013800	.006550			
10,584	54,000	.014750	.006950			
10,780	55,000	.016000	.001250			
17,490	89,230					Tenale strength.

General summary.

Tensile strength, per square inch of original section .....	pounds..	89,230
Elastic limit, per square inch of original section.....	do.	49,000
Elongation per inch after rupture.....	inch.	.280
Elongation per inch under strain at elastic limit.....	do.	.001850
Reduction in diameter at point of rupture.....	do.	.150
Reduction in area after rupture, per centum of original section.....		51.0
Position of rupture.....	1" from neck	
Character of broken surface.....	silky	
Elongation of inch sections .....	.37%, .15	

STEEL FROM BAIL FOR 10-INCH B. L. RIFLE.



No. 5547.

Diameter, ".564.  
 Sectional area, .25 square inch.  
 Elastic limit, 12,540 pounds = 50,160 pounds per square inch.  
 Tensile strength, 15,910 pounds = 73,640 pounds per square inch.  
 Elongation in 2 inches, ".76=38.0 per cent.  
 Elongation of inch sections, ".23, ".53.\*  
 Diameter at fracture, ".34; area .091 square inch.  
 Contraction of area, 63.6 per cent.  
 Appearance of fracture, fine silky.

No. 4577.

Diameter, ".564.  
 Sectional area, .25 square inch.  
 Gauged length, 2".

Applied load.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	0.	
2,500	10,000	.000350	.000250	0.	0.	
5,000	20,000	.000600	.000250	0.	0.	
7,500	30,000	.000850	.000350	0.	0.	
8,750	35,000	.001100	.000150	0.	0.	
9,500	38,000	.001300	.000200	0.	0.	
9,750	39,000	.001250	.030050	0.	0.	
10,000	40,000	.005350	.004000	0.	0.	
10,250	41,000	.007000	.001650	0.	0.	
10,500	42,000	.018000	.011000	0.	0.	Elastic limit.
10,750	43,000	.019000	.001000	0.	0.	
11,000	44,000	.020250	.001250	0.	0.	
15,710	62,840					

General summary.

Tensile strength, per square inch of original section.....	pounds..	62,840
Elastic limit, per square inch of original section.....	do..	39,000
Elongation per inch after rupture.....	inch.....	.380
Elongation per inch under strain at elastic limit.....	do.....	.001350
Reduction in diameter at point of rupture.....	do.....	.164
Reduction in area after rupture, per centum of original section.....	do.....	49.7
Position of rupture.....	.....	at middle of stem
Character of broken surface.....	.....	silky
Elongation of inch sections.....	.....	".35", ".38"

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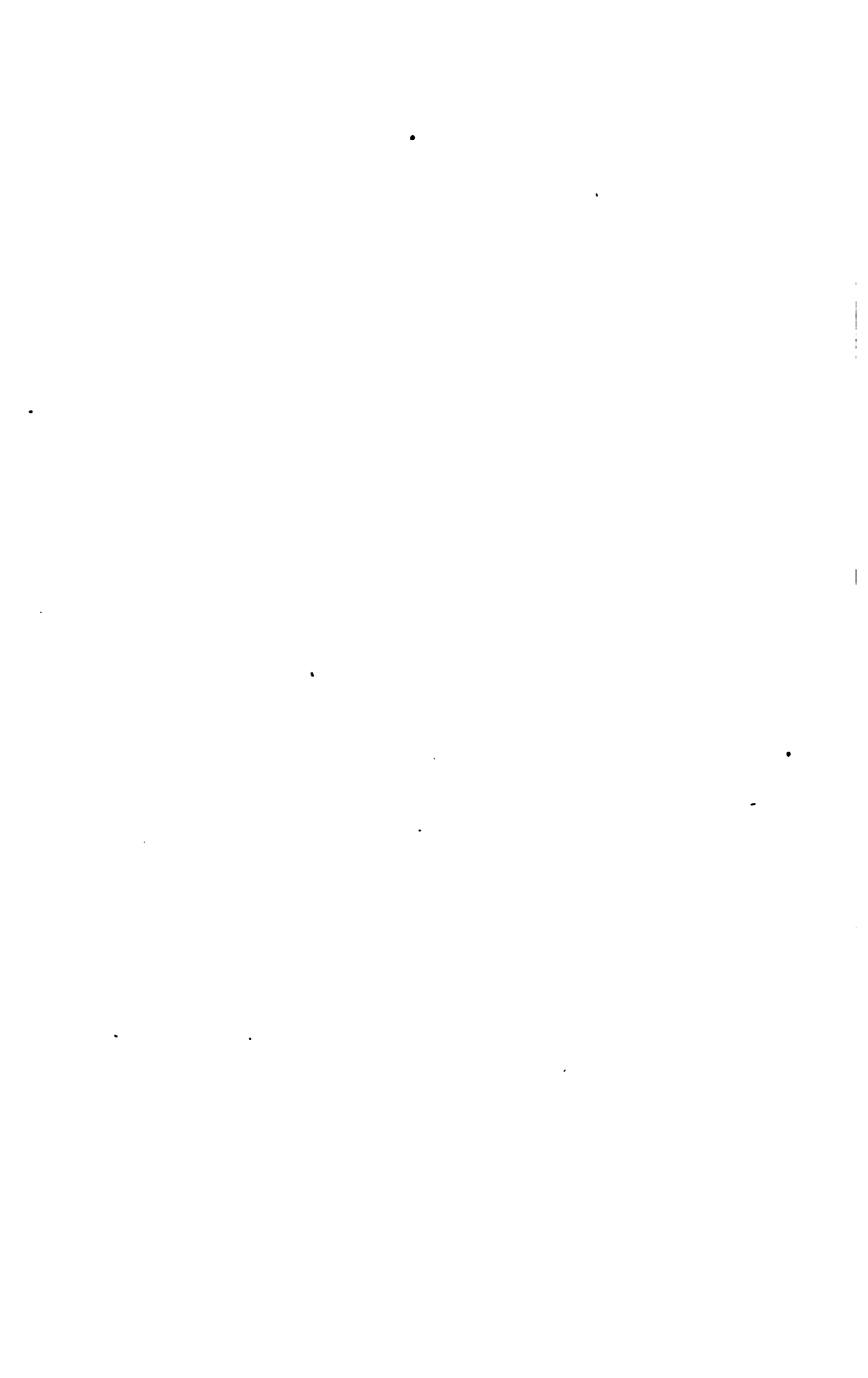
**RIFLE-BARREL STEEL FROM SPRINGFIELD ARMORY**

**FOR**

**BARRELS .30 AND .45 CALIBER.**

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No. 4538.

Marks, .  
 Diameter, ".564.  
 Sectional area, .25 square inch.  
 Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	.....	.....	
2,500	10,000	.000267	.000200	.....	.....	
3,750	15,000	.000433	.000166	.....	.....	
5,000	20,000	.000633	.000200	.....	.....	
6,250	25,000	.000867	.000234	.....	.....	
7,500	30,000	.001033	.000166	0.	.....	
8,750	35,000	.001200	.000167	.....	.....	
10,000	40,000	.001400	.000200	.000033	.000033	
11,250	45,000	.001567	.000167	.....	.....	
12,500	50,000	.001733	.000166	.000033	0.	
13,500	54,000	.001933	.000200	.....	.....	
		.008000	.006007	.....	.....	
13,750	55,000	.008200	.000200	.....	.....	
14,000	56,000	.008600	.000400	.....	.....	
14,250	57,000	.009000	.000400	.....	.....	
14,500	58,000	.009833	.000833	.....	.....	
14,750	59,000	.010333	.000500	.....	.....	
15,000	60,000	.011000	.000667	.....	.....	
26,690	106,760	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section.....	pounds..	106,760
Elastic limit per square inch of original section.....	do...	54,000
Elongation per inch after rupture.....	do...	.1667
Elongation per inch under strain at elastic limit.....	inch...	.001933
Reduction in diameter at point of rupture.....	do...	.084
Reduction in area after rupture, per centum of original section.....	do...	27.6
Position of rupture.....		1 1/8 from neck
Character of broken surface.....	granular, radiating from a dull spot at the circumference	
Elongation of inch sections.....		"11, "21, "18"

No. 4589.

Marks, \*\*  
 Diameter, ".564.  
 Sectional area, .25 square inch.  
 Gauged length, 3'.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
250	1,000	0.	0.	0.	0.		
1,250	5,000	.000087	.000087	.....	.....		
2,500	10,000	.000287	.000200	.....	.....		
3,750	15,000	.000433	.000166	.....	.....		
5,000	20,000	.000633	.000200	.....	.....		
6,250	25,000	.000833	.000200	.....	.....		
7,500	30,000	.001000	.000187	.....	.....		
8,750	35,000	.001187	.000187	.....	.....		
10,000	40,000	.001333	.000166	0.	.....		
11,250	45,000	.001500	.000187	0.	.....		
12,500	50,000	.001700	.000200	0.	.....		
13,000	52,000	.001787	.000087	.....	.....		
13,500	54,000	.001833	.000066	.....	.....		
13,500	54,000	.001900	.000087	.....	.....		
14,000	56,000	.001933	.000033	.....	.....		
14,000	56,000	.001987	.000034	.....	.....		
14,250	57,000	.002033	.000066	.....	.....		
14,500	58,000	.007833	.005800	.....	.....		
14,750	59,000	.008287	.000434	.....	.....		
15,000	60,000	.008700	.000433	.....	.....		
15,250	61,000	.008933	.000233	.....	.....		
15,500	62,000	.009433	.000500	.....	.....		
28,470	113,880	.....	.....	.....	.....		Tensile strength.

General summary.

Tensile strength per square inch of original section.....	pounds..	113,880
Elastic limit per square inch of original section.....	do..	57,000
Elongation per inch after rupture.....	inch..	1467
Elongation per inch under strain at elastic limit.....	do..	.002033
Reduction in diameter at point of rupture.....	do..	.074
Reduction in area after rupture, per centum of original section.....		24.6
Position of rupture.....		1" .10 from neck
Character of broken surface.....		granular radiating from a dull spot at the circumference
Elongation of inch sections.....		".10, ".17, ".17"

No. 4590.

Marks, . . .  
 Diameter, ".564.  
 Sectional area, .25 square inch.  
 Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
250	1,000	0.	0.	0.	0.	
1,250	5,000	.000067	.000067	.....	.....	
2,500	10,000	.000287	.000200	.....	.....	
3,750	15,000	.000433	.000186	.....	.....	
5,000	20,000	.000600	.000187	.....	.....	
6,250	25,000	.000767	.000167	.....	.....	
7,500	30,000	.000933	.000166	.....	.....	
8,750	35,000	.001100	.000167	.....	.....	
10,000	40,000	.001300	.000200	0.	.....	
11,250	45,000	.001500	.000200	.....	.....	
12,500	50,000	.001700	.000200	.....	.....	
12,750	51,000	.001733	.000033	.....	.....	
13,000	52,000	.001767	.000034	.....	.....	
13,250	53,000	.001800	.000033	.....	.....	
13,500	54,000	.001833	.000033	.....	.....	
13,750	55,000	.001800	.000067	.....	.....	
14,000	56,000	.001833	.000033	.....	.....	
14,250	57,000	.001867	.000034	.....	.....	
14,500	58,000	.002267	.000300	.....	.....	
14,750	59,000	.012733	.000466	.....	.....	
15,000	60,000	.013200	.000467	.....	.....	
15,250	61,000	.013900	.000700	.....	.....	
15,500	62,000	.014667	.000767	.....	.....	
25,050	100,200	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section .....	pounds..	100,200
Elastic limit per square inch of original section .....	do.	57,000
Elongation per inch after rupture .....	inch..	.1733
Elongation per inch under strain at elastic limit .....	do.	.001967
Reduction in diameter at point of rupture .....	do.	.094
Reduction in area after rupture, per centum of original section .....		30.6
Position of rupture .....		1".20 from neck
Character of broken surface .....		silky, in part interspersed with fine granulation
Elongation of inch sections .....		".10, ".22*, ".26*

No. 4591.

Marks . . . .  
 Diameter, ".564.  
 Sectional area, .25 square inch.  
 Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	0.	
2,500	10,000	.000300	.000200			
3,750	15,000	.000467	.000167			
5,000	20,000	.000633	.000166			
6,250	25,000	.000800	.000167			
7,500	30,000	.000967	.000167			
8,750	35,000	.001167	.000200			
10,000	40,000	.001367	.000200	0.		
11,250	45,000	.001533	.000166			
12,500	50,000	.001700	.000167			
12,750	51,000	.001733	.000033			Elastic limit.
13,000	52,000	.021600	.019867			
13,250	53,000	.022333	.009733			
13,500	54,000	.024067	.001734			
13,750	55,000	.025067	.001000			
14,000	56,000	.028500	.001433			
14,250	57,000	.028067	.001567			
14,500	58,000	.029833	.001766			
14,750	59,000	.032000	.002167			
15,000	60,000	.034000	.002000			
19,580	78,320					Tensile strength.

General summary.

Tensile strength per square inch of original section.....	pounds..	78,320
Elastic limit, per square inch of original section.....	do. . . .	51,000
Elongation per inch after rupture.....	inch.....	.260
Elongation per inch under strain of elastic limit.....	do. . . .	.001733
Reduction in diameter at point of rupture.....	do. . . .	.154
Reduction in area after rupture, per centum of original section.....		47.2
Position of rupture.....	1".45 from neck.	
Character of broken surface.....	fine silky.	
Elongation of inch sections.....	" .17, ".37, ".24	

No. 4623.

Mark A.  
 Diameter, ".564.  
 Sectional area, .25 square inch.  
 Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000667	.000367	.....	.....	
7,500	30,000	.001000	.000333	— .000033	— .000033	
8,750	35,000	.001167	.000167	.....	.....	
10,000	40,000	.001367	.000200	— .000033	0.	
11,250	45,000	.001533	.000166	.....	.....	
12,500	50,000	.001700	.000167	0.	.000033	
12,750	51,000	.001733	.000033	.....	.....	
13,000	52,000	.001767	.000034	.....	.....	
13,250	53,000	.001800	.000033	.....	.....	
13,500	54,000	.001833	.000033	.....	.....	
13,750	55,000	.001867	.000034	.....	.....	
14,000	56,000	.001900	.000033	.....	.....	
14,250	57,000	.023333	.031433	.....	.....	
14,500	58,000	.036333	.003000	.....	.....	
14,750	59,000	.038000	.001667	.....	.....	
15,000	60,000	.042000	.004000	.....	.....	
15,250	61,000	.045667	.003667	.....	.....	
17,800	71,440	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section .....	pounds..	71,440
Elastic limit per square inch of original section .....	do. ....	56,000
Elongation per inch after rupture .....	inch..	.2800
Elongation per inch under strain at elastic limit .....	do. ....	.001900
Reduction in diameter at point of rupture .....	do. ....	.144
Reduction in area after rupture, per centum of original section .....		44.6
Position of rupture .....		1".5 from neck
Character of broken surface .....		silky
Elongation of inch sections .....		".20, ".40, ".16

No. 4624.

Marks, R I.  
 Diameter, ".564.  
 Sectional area, .25 square inch.  
 Gauged length, 3'.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
250	1,000	0.	0.	0.	0.	
1,250	5,000	.000100	.000100	0.		
2,500	10,000	.000333	.000233			
5,000	20,000	.000667	.000334			
7,500	30,000	.001033	.000366			
10,000	40,000	.001367	.000334	0.		
11,250	45,000	.001567	.000200			
12,500	50,000	.001733	.000166	0.		
13,750	55,000	.001900	.000167			
15,000	60,000	.002100	.000200	0.		
15,500	62,000	.002133	.000032			
16,000	64,000	.002200	.000067			
16,500	66,000	.002267	.000067			
17,000	68,000	.002333	.000066			
17,500	70,000	.002400	.000067			
18,000	72,000	.002433	.000033			
18,500	74,000	.002567	.000134			
19,000	76,000	.002667	.000100			
19,500	78,000	.002767	.000100			
19,750	79,000	.015667	.012900			
20,000	80,000	.016333	.000666			
20,250	81,000	.017167	.000834			
20,500	82,000	.018500	.001333			
28,320	113,280					Tensile strength.

General summary.

Tensile strength per square inch of original section .....	pounds ..	113,280
Elastic limit per square inch of original section .....	do ..	72,000
Elongation per inch after rupture .....	inch ..	.1500
Elongation per inch under strain at elastic limit .....	do ..	.002433
Reduction in diameter at point of rupture .....	do ..	.104
Reduction in area after rupture, per centum of original section .....		33.5
Position of rupture .....	1" from neck	
Character of broken surface .....	silky, cup-shaped	
Elongation of inch sections .....	.08, ".18, ".19"	

No. 4625.

Marks, R I,  
 Diameter, ".564.  
 Sectional area, .25 square inch.  
 Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
250	1,000	0.	0.	0.	0.		
1,250	5,000	.000133	.000133	0.	.....		
2,500	10,000	.000333	.000200	.....	.....		
5,000	20,000	.000700	.000367	.....	.....		
7,500	30,000	.001000	.000300	.....	.....		
10,000	40,000	.001367	.000387	.000033	.000033		
11,250	45,000	.001567	.000200	.....	.....		
12,500	50,000	.001767	.000200	.000033	0.		
13,750	55,000	.001933	.000166	.....	.....		
15,000	60,000	.002133	.000200	.000033	0.		
15,500	62,000	.002238	.000100	.....	.....		
16,000	64,000	{ .002300	.000087 }	.....	.....		Elastic limit.
		{ .022400	.010100 }	.....	.....		
16,250	65,000	.024000	.001600	.....	.....		
16,500	66,000	.025600	.001600	.....	.....		
16,750	67,000	.027267	.001667	.....	.....		
17,000	68,000	.028333	.001066	.....	.....		
17,250	69,000	.030333	.002000	.....	.....		
17,500	70,000	.032333	.002000	.....	.....		
21,840	87,360	.....	.....	.....	.....	Tensile strength.	

General summary.

Tensile strength per square inch of original section.....	pounds..	87,360
Elastic limit per square inch of original section.....	do...	64,000
Elongation per inch after rupture.....	inch..	.2300
Elongation per inch under strain at elastic limit.....	do...	.002300
Reduction in diameter at point of rupture.....	do...	.174
Reduction in area after rupture, per cent of original section.....	.....	52.2
Position of rupture.....	.....	at middle of stem
Character of broken surface.....	.....	fine silky, cup shaped
Elongation of inch sections.....	.....	".14, ".41, ".14

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No. 4675.

Marks, A I<sub>1</sub>  
 Diameter, ".564.  
 Sectional area, .25 square inch.  
 Gauged length, 3'.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Poun ds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
250	1,000	0.	0.	0.	0.	
1,250	5,000	.000100	.000100	0.	0.	Elastic limit; load fell.
2,500	10,000	.000300	.000200	0.	0.	
5,000	20,000	.000833	.000333	0.	0.	
7,500	30,000	.000967	.000334	0.	0.	
8,750	35,000	.001200	.000233	0.	0.	
10,000	40,000	.001333	.000133	0.	0.	
11,250	45,000	.001567	.000234	0.	0.	
10,500	42,000	.008467	.006900	0.	0.	
10,750	43,000	.008667	.000200	0.	0.	
11,000	44,000	.008900	.000233	0.	0.	
11,250	45,000	.009333	.000433	0.	0.	
11,500	46,000	.010433	.001100	0.	0.	
11,750	47,000	.011067	.000634	0.	0.	
12,000	48,000	.013333	.001266	0.	0.	
12,250	49,000	.013067	.000734	0.	0.	
12,500	50,000	.013667	.000600	0.	0.	
13,000	52,000	.015833	.002266	0.	0.	
13,500	54,000	.018333	.002400	0.	0.	
14,000	56,000	.020400	.002007	0.	0.	
14,500	58,000	.022600	.002400	0.	0.	
15,000	60,000	.025000	.002200	0.	0.	
15,500	62,000	.028167	.003167	0.	0.	
16,000	64,000	.031000	.002833	0.	0.	
16,500	66,000	.0350	.0040	0.	0.	
17,000	68,000	.0400	.0050	0.	0.	
17,500	70,000	.0467	.0067	0.	0.	
18,000	72,000	.0500	.0033	0.	0.	
18,500	74,000	.0567	.0067	0.	0.	
19,000	76,000	.0667	.0100	0.	0.	
19,500	78,000	.0733	.0066	0.	0.	
20,000	80,000	.0867	.0134	0.	0.	
20,500	82,000	.1067	.0200	0.	0.	
21,000	84,000	.1367	.0300	0.	0.	
21,250	85,120					Tensile strength.

General summary.

Tensile strength per square inch of original section .....	pounds..	85,120
Elastic limit per square inch of original section .....	do...	45,000
Elongation per inch after rupture .....	inch..	.2600
Elongation per inch under strain at elastic limit .....	do...	.001567
Reduction in diameter at point of rupture .....	do...	.14.6
Reduction in area after rupture, per cent of original section .....		44.6
Position of rupture .....	at middle of stem	
Character of broken surface .....	silky	
Elongation of inch sections .....	"20, "40, "18	

Chemical composition.

	Per cent.
Total carbon .....	0.460
Graphitic carbon .....	0.023
Combined carbon .....	0.386
Manganese .....	0.555
Silicon .....	0.136
Sulphur .....	0.042
Phosphorus .....	0.052



No. 4676.

Marks, A I<sub>2</sub>  
 Diameter, ".564.  
 Sectional area, .25 square inch.  
 Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
250	1,000	0.	0.	0.	0.	
1,250	5,000	.000133	.000133	0.		Elastic limit; load fell.
2,500	10,000	.000333	.000200			
5,000	20,000	.000700	.000367			
7,500	30,000	.001133	.000433			
8,750	35,000	.001300	.000167	.000033	.000013	
10,000	40,000	.001500	.000200	.000067	.000034	
11,250	45,000	.001667	.000167			
10,250	41,000	.006000	.004333			
10,500	42,000	.008667	.002667			
10,750	43,000	.009333	.000366			
11,000	44,000	.009633	.000600			
11,250	45,000	.010267	.000634			
11,500	46,000	.011000	.000733			
11,750	47,000	.011667	.000667			
12,000	48,000	.012300	.001133			
12,500	50,000	.014667	.001867			
13,000	52,000	.016667	.002000			
13,500	54,000	.018667	.002000			
14,000	56,000	.021000	.002333			
14,500	58,000	.023333	.002333			
15,000	60,000	.027000	.003667			
15,500	62,000	.028333	.002333			
16,000	64,000	.032000	.002667			
16,500	66,000	.035667	.003067			
17,000	68,000	.039333	.003666			
17,500	70,000	.044000	.004667			
18,000	72,000	.0467	.0027			
18,500	74,000	.0500	.0033			
19,000	76,000	.0600	.0100			
19,500	78,000	.0733	.0133			
20,000	80,000	.0867	.0134			
20,500	82,000	.1133	.0266			
21,000	84,000	.1700	.0567			Tensile strength.

General summary.

Tensile strength per square inch of original section .....	pounds..	84,000
Elastic limit per square inch of original section .....	do..	45,000
Elongation per inch after rupture .....	inch..	.2433
Elongation per inch under strain at elastic limit .....	do..	.001667
Reduction in diameter at point of rupture .....	do..	.134
Reduction in area after rupture, per cent of original section .....		41.9
Position of rupture .....	at middle of stem	
Character of broken surface .....	silky.	
Elongation of inch sections .....	"16, "30, "18	

No. 4723.

Marks, 2.

Diameter, ".564.

Sectional area, .25 square inch.

Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>		
250	1,000	0.	0.	0.	0.	Initial load.	
1,250	5,000	.000067	.000067	0.	0.		
2,500	10,000	.000233	.000166	.....	.....		
5,000	20,000	.000567	.000334	.....	.....		
7,500	30,000	.000933	.000366	0.	.....		
8,750	35,000	.001067	.000134	.....	.....		
10,000	40,000	.001233	.000166	.000033	.000033		
11,250	45,000	.001433	.000200	.....	.....		
12,500	50,000	.001667	.000234	.000033	0.		
12,750	51,000	.001700	.000333	.....	.....		
13,000	52,000	.001733	.000333	.....	.....		
12,500	50,000	.006667	.004934	.....	.....		Elastic limit; load fell.
12,750	51,000	.018667	.012000	.....	.....		
13,000	52,000	.019667	.001000	.....	.....		
13,500	54,000	.022000	.002333	.....	.....		
14,000	56,000	.026000	.004000	.....	.....		
14,500	58,000	.029333	.003333	.....	.....		
15,000	60,000	.033000	.003667	.....	.....		
15,500	62,000	.038400	.005400	.....	.....		
16,000	64,000	.044333	.005933	.....	.....		
16,500	66,000	.049667	.005334	.....	.....		
17,000	68,000	.058000	.008333	.....	.....		
17,500	70,000	.0700	.0120	.....	.....		
18,000	72,000	.0887	.0167	.....	.....		
18,500	74,000	.1033	.0166	.....	.....		
19,000	76,000	.1333	.0300	.....	.....		
19,310	77,240	.....	.....	.....	.....	Tensile strength.	

*General summary.*

Tensile strength per square inch of original section .....	pounds ..	77,240
Elastic limit per square inch of original section .....	do ..	52,000
Elongation per inch after rupture .....	inch ..	.2833
Elongation per inch under strain at elastic limit .....	do ..	.001733
Reduction in diameter at point of rupture .....	do ..	.194
Reduction in area after rupture, per cent of original section .....	.....	57.0
Position of rupture .....	.....	1".8 from neck
Character of broken surface .....	.....	fine silky
Elongation of inch sections .....	.....	".15, ".50, ".30

*Chemical composition.*

	Per cent.
Total carbon .....	0.320
Graphitic carbon .....	0.080
Combined carbon .....	0.240
Manganese .....	1.342
Silicon .....	0.025
Sulphur .....	0.080
Phosphorus .....	0.045

No. 4724.

Marks, 2.

Diameter, ".565.

Sectional area, .25 square inch.

Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
250	1,000	0.	0.	0.	0.	
1,250	5,000	.000100	.000100	0.	0.	Elastic limit. Load fell.
2,500	10,000	.000333	.000333	0.	0.	
5,000	20,000	.000667	.000334	0.	0.	
7,500	30,000	.001000	.000333	0.	0.	
10,000	40,000	.001337	.000367	0.	0.	
11,250	45,000	.001533	.000186	0.	0.	
12,500	50,000	.001700	.000167	0.	0.	
12,750	51,000	.001733	.000033	0.	0.	
13,000	52,000	.001767	.000034	0.	0.	
13,250	53,000	.001800	.000033	0.	0.	
13,500	54,000	.001833	.000033	0.	0.	
13,750	55,000	.001867	.000034	0.	0.	
14,000	56,000	.002000	.000133	0.	0.	
12,750	51,000	.004067	.004067	0.	0.	
13,000	52,000	.008333	.002266	0.	0.	
13,250	53,000	.018333	.011000	0.	0.	
13,500	54,000	.022333	.003000	0.	0.	
13,750	55,000	.022933	.000600	0.	0.	
14,000	56,000	.024000	.001007	0.	0.	
14,500	58,000	.027733	.003733	0.	0.	
15,000	60,000	.032500	.004707	0.	0.	
15,500	62,000	.037167	.004667	0.	0.	
16,000	64,000	.041667	.004500	0.	0.	
16,500	66,000	.048300	.006633	0.	0.	
17,000	68,000	.053000	.006700	0.	0.	
17,500	70,000	.064000	.008000	0.	0.	
18,000	72,000	.0767	.0127	0.	0.	
18,500	74,000	.0933	.0166	0.	0.	
19,000	76,000	.1200	.0267	0.	0.	
19,420	77,680	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section .....	pounds..	77,680
Elastic limit per square inch of original section.....	do...	55,000
Elongation per inch after rupture.....	inch..	.2833
Elongation per inch under strain at elastic limit .....	do...	.001867
Reduction in diameter at point of rupture.....	do...	.185
Reduction in area after rupture, per cent of original section.....	.....	54.6
Position of rupture.....	.....	1".8 from neck
Character of broken surface.....	.....	fine silky
Elongation of inch sections .....	.....	".18, ".48", ".19

Marks, 4.  
 Diameter, ".564.  
 Sectional area, .25 square inch.  
 Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
250	1,000	0.	0.	0.	0.	
1,250	5,000	.000100	.000100	0.	0.	
2,500	10,000	.000333	.000333	0.	0.	
5,000	20,000	.000667	.000334	0.	0.	
7,500	30,000	.001000	.000333	0.	0.	
10,000	40,000	.001333	.000333	0.	0.	
12,500	50,000	.001667	.000334	0.	0.	
12,750	51,000	.001700	.000333	0.	0.	
13,000	52,000	.001733	.000333	0.	0.	
13,250	53,000	.001767	.000334	0.	0.	
13,500	54,000	.001800	.000333	0.	0.	
13,750	55,000	.001833	.000333	0.	0.	
14,000	56,000	.001900	.000667	0.	0.	
14,250	57,000	.001967	.000667	0.	0.	
14,500	58,000	.002033	.000666	0.	0.	
14,750	59,000	.002067	.000334	0.	0.	
15,000	60,000	.002200	.000133	.000267	.000267	Elastic limit.
15,250	61,000	.002333	.000133	0.	0.	
15,500	62,000	.002467	.000134	0.	0.	
15,750	63,000	.002600	.000133	0.	0.	
16,000	64,000	.004333	.001733	0.	0.	
16,250	65,000	.005400	.001067	0.	0.	
16,500	66,000	.007000	.001600	0.	0.	
17,000	68,000	.011533	.004533	0.	0.	
17,500	70,000	.014333	.002800	0.	0.	
18,000	72,000	.018333	.004000	0.	0.	
18,500	74,000	.023000	.004667	0.	0.	
19,000	76,000	.029000	.006000	0.	0.	
19,500	78,000	.034667	.005667	0.	0.	
20,000	80,000	.041933	.007266	0.	0.	
20,500	82,000	.050000	.008067	0.	0.	
21,000	84,000	.061667	.011667	0.	0.	
21,500	86,000	.0600	.018333	0.	0.	Tensile strength.
21,950	87,800	.....	.....	.....	.....	

General summary.

Tensile strength per square inch of original section .....	pounds ..	87,800
Elastic limit per square inch of original section .....	do ..	59,000
Elongation per inch after rupture .....	inch ..	.2667
Elongation per inch under strain at elastic limit .....	do ..	.002667
Reduction in diameter at point of rupture .....	do ..	.304
Reduction in area after rupture, per cent of original section .....	.....	59.3
Position of rupture .....	.....	".95 from neck
Character of broken surface .....	.....	fine silky
Elongation of inch sections .....	.....	".39", ".12", ".11

Chemical composition.

	Per cent.
Total carbon .....	0.277
Graphitic carbon .....	0.077
Combined carbon .....	0.200
Manganese .....	0.751
Silicon .....	0.024
Sulphur .....	0.117
Phosphorus .....	0.049

No. 4726.

Marks, 4.  
Diameter, ".564.  
Sectional area, .25 square inch.  
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>		
250	1,000	0.	0.	0.	0.	Initial load.	
1,250	5,000	.000100	.000100	0.	0.		
2,500	10,000	.000300	.000200	.....	.....		
5,000	20,000	.000633	.000333	.....	.....		
7,500	30,000	.000967	.000324	.....	.....		
10,000	40,000	.001333	.000366	0.	.....		
12,500	50,000	.001700	.000367	.....	.....		
13,750	55,000	.001900	.000200	.....	.....		
14,000	56,000	.001967	.000067	.....	.....		
14,250	57,000	.002033	.000067	.....	.....		
14,500	58,000	.002100	.000067	.....	.....		
14,750	59,000	.002167	.000067	.....	.....		
15,000	60,000	.002333	.000166	.000333	.000333		Elastic limit.
15,250	61,000	.002467	.000134	.....	.....		
15,500	62,000	.004333	.000866	.....	.....		
15,750	63,000	.006933	.002800	.....	.....		
16,000	64,000	.008333	.001400	.....	.....		
16,250	65,000	.009667	.001334	.....	.....		
16,500	66,000	.011333	.001666	.....	.....		
17,000	68,000	.015000	.003667	.....	.....		
17,500	70,000	.020333	.005333	.....	.....		
18,000	72,000	.023000	.002667	.....	.....		
18,500	74,000	.028000	.005000	.....	.....		
19,000	76,000	.034333	.006333	.....	.....		
19,500	78,000	.040333	.006000	.....	.....		
20,000	80,000	.048667	.008334	.....	.....		
20,500	82,000	.061667	.013000	.....	.....		
21,000	84,000	.076667	.015000	.....	.....		
21,500	86,000	.14	.063333	.....	.....	Tensile strength.	

General summary.

Tensile strength per square inch of original section .....	pounds..	86,000
Elastic limit per square inch of original section .....	do ..	59,000
Elongation per inch after rupture .....	inch ..	.2167
Elongation per inch under strain at elastic limit .....	do ..	.002167
Reduction in diameter at point of rupture .....	do ..	.204
Reduction in area after rupture, per cent of original section .....		59.3
Position of rupture .....	" .75 from neck	
Character of broken surface .....	fine silky	
Elongation of inch sections .....	" .37, ".14, ".14	

No. 4727.

Marks, 6.  
 Diameter, ".564.  
 Sectional area, .25 square inch.  
 Gauged length, 3'.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.		
2,500	10,000	.000267	.000200			
5,000	20,000	.000633	.000366			
7,500	30,000	.001000	.000367			
10,000	40,000	.001367	.000367	0.		
12,500	50,000	.001700	.000333	0.		
13,750	55,000	.001867	.000167			
15,000	60,000	.002033	.000166	.000033	.000033	
16,250	65,000	.002233	.000200			
17,500	70,000	.002433	.000200	.000033	0.	
17,750	71,000	.002467	.00034.			
18,000	72,000	.002533	.000066			
18,250	73,000	.002600	.000067			
18,500	74,000	.002667	.000067			
18,750	75,000	.002700	.000033			
19,000	76,000	.002733	.000033			
19,250	77,000	.002767	.000034			
19,500	78,000	.002800	.000033			
19,750	79,000	.002867	.000067			
20,000	80,000	.003000	.000133	.000167	.000133	Elastic limit.
20,250	81,000	.003033	.000033			
20,500	82,000	.003067	.000034			
20,750	83,000	.003133	.000066			
21,000	84,000	.003200	.000067			
21,250	85,000	.003333	.000133	.000367	.000200	
21,500	86,000	.003400	.000067			
21,750	87,000	.003500	.000100			
22,000	88,000	.003667	.000167			
22,250	89,000	.003767	.000100			
22,500	90,000	.004133	.000366	.000933	.000566	
22,750	91,000	.004333	.000200			
23,000	92,000	.004633	.000300			
23,250	93,000	.005000	.000367			
23,500	94,000	.005600	.000800			
23,750	95,000	.007000	.001200			
24,000	96,000	.007667	.000667			
24,250	97,000	.008667	.001000			
24,500	98,000	.012167	.003500			
24,750	99,000	.013333	.001166			
25,000	100,000	.016333	.003000	.012300	.011367	
250	1,000					Rested under this load twenty minutes.
25,250	101,000	.016733	.000100			
25,500	102,000	.018000	.001267			
25,750	103,000	.022000	.004000			
26,000	104,000	.027000	.005000			
26,250	105,000	.020667	.002667			
26,500	106,000	.0400	.010333			
27,000	108,000	.0433	.0033			
27,500	110,000	.0600	.0167			
27,910	111,640					

General summary.

Tensile strength per square inch of original section	..... pounds	111,640
Elastic limit per square inch of original section	..... do	79,000
Elongation per inch after rupture	..... inch	.1567
Elongation per inch under strain at elastic limit	..... do	.002667
Reduction in diameter at point of rupture	..... do	.174
Reduction in area after rupture, per cent of original section	..... do	52.2
Position of rupture	.....	.8 from neck
Character of broken surface	.....	fine silky
Elongation of inch sections	.....	.06, .09, .13

No. 4728.

Marks, 6.

Diameter, ".564.

Sectional area, .25 square inch.

Gauged length, 3'.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.		
250	1,000	0.	0.	0.	0.	Initial load.	
1,250	5,000	.000067	.000067	0.	0.		
2,500	10,000	.000267	.000260				
5,000	20,000	.000633	.000366				
7,500	30,000	.001000	.000367				
10,000	40,000	.001333	.000333	0.			
12,500	50,000	.001667	.000334				
15,000	60,000	.002000	.000333	0.			
16,250	65,000	.002167	.000177				
17,500	70,000	.002333	.000166	0.			
18,750	75,000	.002600	.000267	.000033	.000033		
19,000	76,000	.002633	.000033				
19,250	77,000	.002667	.000034				
19,500	78,000	.002700	.000033				
19,750	79,000	.002733	.000033				
20,000	80,000	.002833	.000100	.000100	.000067		Elastic limit.
20,250	81,000	.002933	.000100				
20,500	82,000	.002967	.000034				
20,750	83,000	.003000	.000033				
21,000	84,000	.003033	.000033				
21,250	85,000	.003167	.000134	.000267	.000167		
21,500	86,000	.003300	.000133				
21,750	87,000	.003333	.000033				
22,000	88,000	.003367	.000034				
22,250	89,000	.003433	.000066				
22,500	90,000	.003733	.000300	.000633	.000366		
22,750	91,000	.003867	.000134				
23,000	92,000	.003967	.000100				
23,250	93,000	.004167	.000200				
23,500	94,000	.004700	.000533				
23,750	95,000	.005000	.000500				
24,000	96,000	.005667	.000667				
24,250	97,000	.006833	.001166				
24,500	98,000	.006667	.001814				
24,750	99,000	.009333	.003666				
25,000	100,000	.010833	.001500	.007067	.000434		
25,250	101,000	.011667	.000834				
25,500	102,000	.014000	.002333				
25,750	103,000	.016333	.002333				
26,000	104,000	.019833	.003500				
26,250	105,000	.022400	.002567				
26,500	106,000	.027000	.004600				
26,750	107,000	.028333	.001333				
27,000	108,000	.033967	.005634				
27,250	109,000	.035333	.001366				
27,500	110,000	.042167	.006834				
28,000	112,000	.0600	.017833				
28,300	113,200					Tensile strength.	

General summary.

Tensile strength per square inch of original section	pounds..	113,200
Elastic limit per square inch of original section	do	79,000
Elongation per inch after rupture	inch	.1333
Elongation per inch under strain at elastic limit	do	.002733
Reduction in diameter at point of rupture	do	.164
Reduction in area after rupture, per cent of original section		49.7
Position of rupture	"	6 from neck
Character of broken surface		fine silky
Elongation of inch sections	"	.03, ".06, ".31"

Chemical composition.

	Per cent.
Total carbon	0.324
Graphitic carbon	0.059
Combined carbon	0.265
Manganese	1.349
Silicon	0.033
Sulphur	0.075
Phosphorus	0.045

No. 4741.

Marks, 7.  
 Diameter, ".564.  
 Sectional area, .25 square inch.  
 Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	0.	
2,500	10,000	.000367	.000234	0.	0.	
5,000	20,000	.000967	.000300	0.	0.	
7,500	30,000	.001033	.000306	0.	0.	
10,000	40,000	.001400	.000387	0.	0.	
12,500	50,000	.001733	.000333	0.	0.	
15,000	60,000	.002133	.000400	0.	0.	
17,500	70,000	.002467	.000334	0.	0.	
20,000	80,000	.002967	.000400	0.	0.	
21,250	85,000	.003000	.000133	0.	0.	
21,500	86,000	.003067	.000067	0.	0.	
21,750	87,000	.003167	.000100	0.	0.	
22,000	88,000	.003267	.000100	0.	0.	
22,250	89,000	.003333	.000066	0.	0.	
22,500	90,000	.004000	.000667	.000800	.000800	Elastic limit not well defined.
22,750	91,000	.004000	.000400	0.	0.	
23,000	92,000	.005033	.000633	0.	0.	
23,250	93,000	.006033	.001000	0.	0.	
23,500	94,000	.007167	.001134	0.	0.	
23,750	95,000	.009667	.002500	0.	0.	
24,000	96,000	.010700	.001033	0.	0.	
24,250	97,000	.012167	.001467	0.	0.	
24,500	98,000	.015000	.002833	0.	0.	
24,750	99,000	.016667	.001667	0.	0.	
25,000	100,000	.019333	.002666	0.	0.	
26,000	104,000	.0267	.007367	0.	0.	
27,000	108,000	.0400	.0133	0.	0.	
28,000	112,000	.0700	.0300	0.	0.	
28,040	112,160					

## General summary.

Tensile strength per square inch of original section.....	pounds..	112,160
Elastic limit per square inch of original section.....	do...	86,000
Elongation per inch after rupture.....	inch..	.1500
Elongation per inch under strain at elastic limit.....	do...	.003067
Reduction in diameter at point of rupture.....	do...	.184
Reduction in area after rupture, per cent of original section.....	do...	54.6
Position of rupture.....	"5 from neck	
Character of broken surface.....	fine silky	
Elongation of inch sections.....	"34", "06", "66	



No. 4742.

Marks, 7.  
 Diameter, ".564.  
 Sectional area, 25 square inches.  
 Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
250	1,000	0.	0.	0.	0.	
1,250	5,000	.000100	.000100	.....	.....	
2,500	10,000	.000333	.000233	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
10,000	40,000	.001367	.000367	0.	.....	
12,500	50,000	.001700	.000333	.....	.....	
15,000	60,000	.002033	.000333	.000033	.000033	
17,500	70,000	.002400	.000367	.....	.....	
19,500	78,000	.002667	.000267	.....	.....	
19,750	79,000	.002767	.000100	.....	.....	
20,000	80,000	.002867	.000100	.000067	.000034	
20,250	81,000	.002900	.000033	.....	.....	
20,500	82,000	.002967	.000067	.....	.....	
20,750	83,000	.003000	.000033	.....	.....	
21,000	84,000	.003067	.000033	.....	.....	
21,250	85,000	.003067	.000034	.....	.....	
21,500	86,000	.003167	.000100	.....	.....	
21,750	87,000	.003300	.000133	.....	.....	
22,000	88,000	.003400	.000100	.....	.....	
22,250	89,000	.003500	.000100	.....	.....	
22,500	90,000	.003667	.000187	.000467	.000400	
22,750	91,000	.003933	.000266	.....	.....	
23,000	92,000	.004133	.000200	.....	.....	
23,250	93,000	.004600	.000467	.....	.....	
23,500	94,000	.005000	.000400	.....	.....	
23,750	95,000	.005767	.000767	.....	.....	
24,000	96,000	.007333	.001566	.....	.....	
24,250	97,000	.008933	.001600	.....	.....	
24,500	98,000	.011367	.002434	.....	.....	
24,750	99,000	.013267	.001900	.....	.....	
25,000	100,000	.016000	.002733	.....	.....	
25,250	101,000	.017600	.001600	.....	.....	
25,500	102,000	.020600	.033000	.....	.....	
25,750	103,000	.022667	.002067	.....	.....	
26,000	104,000	.024933	.002266	.....	.....	
26,250	105,000	.027000	.002067	.....	.....	
26,500	106,000	.030000	.003000	.....	.....	
26,750	107,000	.032667	.002667	.....	.....	
27,000	108,000	.035667	.003000	.....	.....	
27,250	109,000	.038333	.002666	.....	.....	
27,500	110,000	.044667	.006334	.....	.....	
28,000	112,000	.0567	.012033	.....	.....	
28,500	114,000	.0733	.0166	.....	.....	
28,740	114,960	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section.....	pounds..	114,960
Elastic limit per square inch of original section.....	do...	85,000
Elongation per inch after rupture.....	inch...	.1833
Elongation per inch under strain at elastic limit.....	do...	.003067
Reduction in diameter at point of rupture.....	do...	.194
Reduction in area after rupture, per cent of original section.....	do...	57.0
Position of rupture.....	1".	08 from neck
Character of broken surface.....	.....	fine silky
Elongation of inch sections.....	" .35", "	.12, ".08

Chemical composition.

	Per cent.
Total carbon.....	0.324
Graphitic carbon.....	0.014
Combined carbon.....	0.310
Manganese.....	0.601
Silicon.....	0.167
Sulphur.....	0.034
Phosphorus.....	0.077

No. 4743.

Marks, 8.  
 Diameter, ".564.  
 Sectional area, .25 square inch.  
 Gauged length, 3".

Applied load.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.		
2,500	10,000	.000333	.000200			
5,000	20,000	.000700	.000367			
7,500	30,000	.001033	.000333			
10,000	40,000	.001367	.000334	0.		
12,500	50,000	.001700	.000333			
15,000	60,000	.002067	.000367	0.		
17,500	70,000	.002433	.000333			
20,000	80,000	.002900	.000367	0.		
22,500	90,000	.003233	.000433	0.		
25,000	100,000	.003667	.000434	.000133	.000133	
25,250	101,000	.003700	.000033			
25,500	102,000	.003667	.000067			
25,750	103,000	.003833	.000066			
26,000	104,000	.003933	.000100			
26,250	105,000	.004000	.000067			
26,500	106,000	.004033	.000033			
26,750	107,000	.004067	.000034			
27,000	108,000	.004200	.000133			
27,250	109,000	.004300	.000100			
27,500	110,000	.004367	.000067	.000567	.000434	
27,750	111,000	.004500	.000133			
28,000	112,000	.004367	.000167			
28,250	113,000	.004767	.000100			
28,500	114,000	.005000	.000233			
28,750	115,000	.005167	.000167			
29,000	116,000	.005400	.000233			
29,250	117,000	.005700	.000300			
29,500	118,000	.006000	.000300			
29,750	119,000	.006400	.000400			
30,000	120,000	.007567	.001167	.003600	.002433	
31,000	124,000	.0133	.005733			
32,000	128,000	.0233	.0100			
33,000	132,000	.0300	.0067			
34,000	136,000	.0533	.0233			
34,320	137,280					Tensile strength.

General summary.

Tensile strength per square inch of original section .....	pounds	137,280
Elastic limit per square inch of original section .....	do	107,000
Elongation per inch after rupture .....	inch	.1333
Elongation per inch under strain at elastic limit .....	do	.004067
Reduction in diameter at point of rupture .....	do	.154
Reduction in area after rupture, per cent of original section .....		47.2
Position of rupture .....	1".17 from the neck	
Character of broken surface .....	fine silky	
Elongation of inch sections .....	".17", ".18", ".16	

No. 4744.

Marks, 8.  
 Diameter, ".564.  
 Sectional area, .25 square inch  
 Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	0.	
2,500	10,000	.000267	.000167	0.	0.	
5,000	20,000	.000600	.000333	0.	0.	
7,500	30,000	.000933	.000333	0.	0.	
10,000	40,000	.001300	.000367	0.	0.	
12,500	50,000	.001667	.000367	0.	0.	
15,000	60,000	.002000	.000333	0.	0.	
17,500	70,000	.002367	.000367	0.	0.	
20,000	80,000	.002700	.000333	0.	0.	
22,500	90,000	.003033	.000433	0.	0.	
25,000	100,000	.003400	.000367	0.	0.	
27,500	110,000	.003767	.000367	.000033	.000033	
27,750	111,000	.003800	.000333	0.	0.	
28,000	112,000	.003833	.000333	0.	0.	
28,250	113,000	.003900	.000367	0.	0.	
28,500	114,000	.003967	.000367	0.	0.	
28,750	115,000	.004033	.000366	0.	0.	
29,000	116,000	.004067	.000334	0.	0.	
29,250	117,000	.004100	.000333	0.	0.	
29,500	118,000	.004133	.000333	0.	0.	
29,750	119,000	.004267	.000134	0.	0.	
30,000	120,000	.004300	.000100	.000167	.000134	
30,250	121,000	.004333	.000066	0.	0.	
30,500	122,000	.004500	.000067	0.	0.	
30,750	123,000	.004600	.000100	0.	0.	
31,000	124,000	.004733	.000133	0.	0.	
31,250	125,000	.004867	.000134	0.	0.	
31,500	126,000	.005067	.000200	0.	0.	
31,750	127,000	.005233	.000166	0.	0.	
32,000	128,000	.005433	.000200	0.	0.	
32,250	129,000	.005733	.000300	0.	0.	
32,500	130,000	.006033	.000300	.001367	.001200	
32,750	131,000	.006300	.000267	0.	0.	
33,000	132,000	.006600	.000300	0.	0.	
33,250	133,000	.006933	.000333	0.	0.	
33,500	134,000	.008033	.001100	0.	0.	
33,750	135,000	.008733	.000700	0.	0.	
34,000	136,000	.009700	.000867	0.	0.	
34,250	137,000	.010400	.000700	0.	0.	
34,500	138,000	.011833	.001433	0.	0.	
35,000	140,000	.0167	.004867	0.	0.	
36,000	144,000	.0233	.0066	0.	0.	
36,820	147,280	.0500	.0267	0.	0.	Tensile strength.

General summary.

Tensile strength per square inch of original section	..... pounds..	147,280
Elastic limit per square inch of original section	..... do ..	122,000
Elongation per inch after rupture	..... inch..	.0933
Elongation per inch under strain at elastic limit	..... do ..	.004500
Reduction in diameter at point of rupture	..... do ..	.124
Reduction in area after rupture, per cent of original section	..... do ..	39.2
Position of rupture	..... "	.55 from neck
Character of broken surface	.....	fine silky
Elongation of inch sections	..... "	.23", ".03", ".02

Chemical composition.

	Per cent.
Total carbon	0.865
Graphitic carbon	0.074
Combined carbon	0.291
Manganese	0.547
Silicon	0.139
Sulphur	0.038
Phosphorus	0.026

No. 4664.

Marks, Feb. 15, 92.  
 Diameter, ".564.  
 Sectional area, .25 square inch.  
 Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000167	.000167	0.	0.	
2,500	10,000	.000367	.000200	0.	0.	
5,000	20,000	.000700	.000333	0.	0.	
7,500	30,000	.001033	.000333	0.	0.	
8,750	35,000	.001233	.000200	0.	0.	
10,000	40,000	.001400	.000167	0.	0.	
10,250	41,000	.001433	.000033	0.	0.	
10,500	42,000	.001500	.000067	0.	0.	
10,750	43,000	.028333	.028333	0.	0.	
11,000	44,000	.030667	.002334	0.	0.	
11,250	45,000	.033333	.002668	0.	0.	
11,500	46,000	.037000	.003987	0.	0.	
11,750	47,000	.040000	.003000	0.	0.	Tensile strength.
15,510	62,040	.....	.....	.....	.....	

General summary.

Tensile strength per square inch of original section .....	pounds..	62,040
Elastic limit per square inch of original section .....	do.	42,000
Elongation per inch after rupture .....	inch..	.3100
Elongation per inch under strain at elastic limit .....	do.	.001500
Reduction in diameter at point of rupture .....	do.	.194
Reduction in area after rupture, per cent of original section .....		57.0
Position of rupture .....	1" 8	from neck
Character of broken surface .....		fine silky
Elongation of inch sections .....	" 21, " 51, " 31	

No. 4665.

Marks, Dec. 12, 91.

Diameter, ".564.

Sectional area, .25 square inch.

Gauged length, 3'.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000187	.000187	0.		
2,500	10,000	.000333	.000166	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001000	.000333	0.	.....	
8,750	35,000	.001200	.000200	.....	.....	
10,000	40,000	.001367	.000167	0.	.....	
10,250	41,000	.001400	.000033	.....	.....	
10,500	42,000	.001433	.000033	.....	.....	
10,750	43,000	.001467	.000034	.....	.....	
11,000	44,000	.001600	.000133	.....	.....	Elastic limit.
		.023333	.021733	.....	.....	
11,250	45,000	.025667	.002334	.....	.....	
11,500	46,000	.028167	.002500	.....	.....	
11,750	47,000	.030333	.002166	.....	.....	
12,000	48,000	.032667	.003334	.....	.....	Tensile strength.
16,320	65,280	.....	.....	.....	.....	

General summary.

Tensile strength per square inch of original section .....	pounds..	65,280
Elastic limit per square inch of original section .....	do.	43,000
Elongation per inch after rupture .....	inch.	.3067
Elongation per inch under strain at elastic limit .....	do.	.001600
Reduction in diameter at point of rupture .....	do.	.194
Reduction in area after rupture, per cent of original section .....		57.0
Position of rupture .....		1".6 from neck
Character of broken surface .....		fine silky
Elongation of inch sections .....		"17, "50, "25

RIFLE BARREL STEEL FROM SPRINGFIELD ARMORY.

FOR BARRELS, .30 AND .45 CALIBER.

TABULATION OF TENSION SPECIMENS.

No. of test.	Marks.	Diameter.	Sectional area.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation in 3 inches.	Area at fracture.	Contraction of area.	Appearance of fracture.	Elongation of inch sections.
		Inch.	Sq. in.	Pounds.	Pounds.	Inch. Per cent.	Inch. Sq. in.	Per cent.		" "
4588	•	.564	.25	54,000	109,760	.50 16.7	Diam., .48 = 1.81	27.6	Granular, radiating from a dull spot at circumference.	" 11, .21", 18
4589	•	.564	.25	57,000	113,890	.44 14.7	Diam., .44 = 1.80	24.6	do.	10, .22", 20*
4590	•	.564	.25	57,000	109,200	.52 17.3	Diam., .47 = 1.74	30.6	Silky, in part interspersed with fine granulation.	.17, .37", 24
4591	•	.564	.25	51,000	78,320	.78 28.0	Diam., .41 = 1.32	47.2	Fine silky	20, .40", 16
4623	•	.564	.25	56,000	71,440	.78 28.0	Diam., .42 = 1.39	44.6	Silky	.08, .18", 19*
4624	•	.564	.25	72,000	113,280	.45 15.0	Diam., .46 = 1.66	33.5	Silky, cup shaped	14, .41", 14
4625	•	.564	.25	64,000	87,860	.69 23.0	Diam., .39 = 1.19	52.2	Fine silky, cup shaped.	20, .10", 18
4626	•	.564	.25	45,000	85,120	.73 24.3	Diam., .42 = 1.39	44.6	do.	16, .39", 18
4676	•	.564	.25	45,000	84,900	.73 24.3	Diam., .43 = 1.45	41.9	do.	18, .50", 20
4723	•	.564	.25	52,000	77,240	.88 29.3	Diam., .37 = 1.08	57.0	Fine silky	18, .48", 19
4724	•	.564	.25	55,000	77,880	.85 28.3	Diam., .38 = 1.13	54.6	do.	39", 12, 11
4725	•	.564	.25	59,000	87,860	.62 20.7	Diam., .36 = 1.02	59.3	do.	.37", 14, 14
4726	•	.564	.25	59,000	86,000	.65 21.7	Diam., .36 = 1.02	59.3	do.	.05, .09, .33*
4727	•	.564	.25	79,000	111,640	.47 15.7	Diam., .39 = 1.19	52.2	do.	.34, .06, .31*
4728	•	.564	.25	79,000	113,200	.40 13.3	Diam., .40 = 1.28	49.7	do.	.85", 12, .08
4741	•	.564	.25	86,000	112,160	.45 15.0	Diam., .38 = 1.13	54.6	do.	.17", .18", .05
4742	•	.564	.25	85,000	114,960	.55 18.3	Diam., .37 = 1.08	57.0	do.	.23", .03, .02
4743	•	.564	.25	107,000	137,280	.40 13.3	Diam., .41 = 1.72	47.2	do.	.21, .51", 21
4744	•	.564	.25	122,000	147,280	.98 9.3	Diam., .44 = 1.52	39.2	do.	.17, .50", 23
4664	Feb. 15, 1892	.564	.25	42,000	62,040	.83 31.0	Diam., .37 = 1.08	57.0	do.	
4665	Dec. 12, 1891	.564	.25	43,000	65,280	.92 30.7	Diam., .37 = 1.08	57.0	do.	

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**STEEL FOR PRESSURE GAUGES.**

**TENSION AND COMPRESSION TESTS.**





SPECIMENS TURNED DOWN FROM A BAR  $1\frac{1}{8}$  INCHES DIAMETER, MARKED  
 "SANDBERSON BROS. & CO. DOUBLE EXTRA STEEL 6".

No. 4690.

Mark, S.  
 Diameter, ".564.  
 Sectional area, .25 square inch.  
 Gauged length, 2".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.		
2,500	10,000	.000350	.000250			
5,000	20,000	.000650	.000300			
7,500	30,000	.001000	.000350			
8,750	35,000	.001150	.000150			
10,000	40,000	.001200	.000150	0.		
11,250	45,000	.001500	.000200			
12,500	50,000	.001600	.000100			
12,750	51,000	.001650	.000050			
13,000	52,000	.001700	.000050			
12,000	48,000	.000950	.007800			
12,250	49,000	.010550	.001050			
12,500	50,000	.011500	.000850			
12,750	51,000	.011900	.000400			
13,000	52,000	.012450	.000550			
13,250	53,000	.012700	.000250			
13,500	54,000	.012900	.000200			
13,750	55,000	.013150	.000250			
14,000	56,000	.013600	.000450			
14,250	57,000	.014000	.000400			
14,500	58,000	.014650	.000650			
14,750	59,000	.015150	.000500			
15,000	60,000	.015950	.000800			
15,500	62,000	.017400	.001450			
16,000	64,000	.018500	.001100			
16,500	66,000	.020150	.001650			
17,000	68,000	.021550	.001400			
17,500	70,000	.022950	.002400			
18,000	72,000	.025500	.001550			
18,500	74,000	.028100	.002600			
19,000	76,000	.031000	.002900			
19,500	78,000	.033500	.002500			
20,000	80,000	.037000	.003500			
23,300	93,440					Tensile strength.

General summary.

Tensile strength per square inch of original section .....	pounds..	93,440
Elastic limit per square inch of original section .....	do. . .	52,000
Elongation per inch after rupture .....	inch. . .	.1550
Elongation per inch under strain at elastic limit .....	do. . .	.001700
Reduction in diameter at point of rupture .....	do. . .	.054
Reduction in area after rupture, per cent of original section .....	do. . .	18.3
Position of rupture .....	1".15 from neck	
Character of broken surface .....	fine granular	
Elongation of inch sections .....	" .16", ".15"	

Chemical composition.

	Per cent.
Total carbon .....	1.145
Graphitic carbon .....	0.063
Combined carbon .....	1.082
Manganese .....	0.129
Silicon .....	0.230
Sulphur .....	0.008
Phosphorus .....	0.006

No. 1057.

Marks, S.  
 Length, 4".  
 Diameter, ".798.  
 Sectional area, .50 square inch.  
 Gauged length, 3".

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
500	1,000	0.	0.	0.	0.	Initial load.
5,000	10,000	.000300	.000300	0.	.....	
10,000	20,000	.000667	.000667	.....	.....	Elastic limit.
15,000	30,000	.000967	.000967	.....	.....	
20,000	40,000	.001267	.000300	0.	.....	
22,500	45,000	.001400	.000133	.....	.....	
24,000	48,000	.001500	.000100	.....	.....	
24,500	49,000	.002633	.001133	.....	.....	
25,000	50,000	.011167	.008534	.....	.....	
25,500	51,000	.011267	.000100	.....	.....	
26,000	52,000	.011467	.000200	.....	.....	
26,500	53,000	.011633	.000166	.....	.....	
27,000	54,000	.012367	.000734	.....	.....	
27,500	55,000	.012600	.000233	.....	.....	
28,000	56,000	.012867	.000267	.....	.....	
28,500	57,000	.013233	.000366	.....	.....	
29,000	58,000	.013867	.000634	.....	.....	
29,500	59,000	.014300	.000433	.....	.....	
30,000	60,000	.014700	.000400	.....	.....	
31,000	62,000	.015700	.001000	.....	.....	
32,000	64,000	.016700	.001000	.....	.....	
33,000	66,000	.017933	.001233	.....	.....	
34,000	68,000	.019033	.001100	.....	.....	
35,000	70,000	.020333	.001300	.....	.....	
49,100	98,200	.....	.....	.....	.....	Ultimate strength.

Failed by double flexure.

No. 1058.

Mark, S.  
 Length, 4".  
 Diameter, ".798.  
 Sectional area, .50 square inch.  
 Gauged length, 3".

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
500	1,000	0.	0.	0.	0.	
5,000	10,000	.000300	.000300	0.	.....	Elastic limit.
10,000	20,000	.000667	.000667	.....	.....	
15,000	30,000	.001000	.000333	.....	.....	
20,000	40,000	.001333	.000333	0.	.....	
22,500	45,000	.001467	.000134	.....	.....	
24,000	48,000	.001567	.000100	.....	.....	
24,500	49,000	.001700	.000133	.....	.....	
25,000	50,000	.006667	.006667	.....	.....	
25,500	51,000	.010500	.001833	.....	.....	
25,500	51,000	.010800	.003300	.....	.....	
26,000	52,000	.011000	.002200	.....	.....	
26,500	53,000	.011333	.003333	.....	.....	
27,000	54,000	.011800	.004467	.....	.....	
27,500	55,000	.012167	.003367	.....	.....	
28,000	56,000	.012500	.003333	.....	.....	
28,500	57,000	.012967	.004467	.....	.....	
29,000	58,000	.013467	.005500	.....	.....	
29,500	59,000	.014000	.005533	.....	.....	
30,000	60,000	.014400	.004400	.....	.....	
31,000	62,000	.015233	.006833	.....	.....	
32,000	64,000	.016367	.001134	.....	.....	
33,000	66,000	.017467	.001100	.....	.....	
34,000	68,000	.018467	.001000	.....	.....	
35,000	70,000	.019000	.001333	.....	.....	
38,400	106,800	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

SPECIMENS TURNED DOWN FROM A BAR 2 INCHES DIAMETER, MARKED  
 "(R A) HOBSON WARRANTED CAST STEEL (CHOICE) (XX) EXTRA".

No. 4691.

Mark, H.  
 Diameter, ".564.  
 Sectional area, .25 square inch.  
 Gauged length, 2".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
250	1,000	0.	0.	0.	0.	
1,250	5,000	.000100	.000100	0.	0.	
2,500	10,000	.000350	.000250	0.	0.	
5,000	20,000	.000650	.000300	0.	0.	
7,500	30,000	.001050	.000400	0.	0.	
8,750	35,000	.001150	.000100	0.	0.	
10,000	40,000	.001400	.000250	0.	0.	
11,250	45,000	.001550	.000150	0.	0.	
12,500	50,000	.001850	.000100	0.	0.	
13,750	55,000	.001900	.000250	0.	0.	
15,000	60,000	.002050	.000150	0.	0.	
16,250	65,000	.002200	.000150	0.	0.	
17,500	70,000	.002450	.000250	.000050	.000050	
17,750	71,000	.002500	.000350	0.	0.	
18,000	72,000	.002600	.000350	0.	0.	
18,250	73,000	.002800	.000350	0.	0.	
18,500	74,000	.002950	.000450	0.	0.	
18,750	75,000	.003000	.000450	0.	0.	
19,000	76,000	.003250	.000450	0.	0.	
19,250	77,000	.003500	.000350	0.	0.	
19,500	78,000	.003500	.000500	0.	0.	
19,750	79,000	.003500	.000350	0.	0.	
20,000	80,000	.003500	.000550	.012150	.012100	
27,930	111,720	0.16800	0.00550	0.	0.	Tensile strength.

General summary.

Tensile strength per square inch of original section.....	pounds..	111,720
Elastic limit per square inch of original section.....	do..	71,000
Elongation per inch after rupture.....	inch..	.0650
Elongation per inch under strain at elastic limit.....	do..	.002500
Reduction in diameter at point of rupture.....	do..	.024
Reduction in area after rupture, per cent of original section.....		8.4
Position of rupture.....	1".06 from neck	
Character of broken surface.....	Fine granular	
Elongation of inch sections.....	" .06", ".05"	

Chemical composition.

	Per cent.
Total carbon.....	1.200
Graphitic carbon.....	0.054
Combined carbon.....	1.146
Manganese.....	0.103
Silicon.....	0.105
Sulphur.....	0.010
Phosphorus.....	0.025

No. 1059.

Mark, H.  
 Length, 4".  
 Diameter, ".798.  
 Sectional area, .50 square inch.  
 Ganged length, 3".

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
500	1,000	0.	0.	0.	0.	
5,000	10,000	.000333	.000333	0.	.....	
10,000	20,000	.000767	.000434	.....	.....	
15,000	30,000	.001100	.000333	.....	.....	
20,000	40,000	.001433	.000333	0.	.....	
22,500	45,000	.001600	.000167	.....	.....	
25,000	50,000	.001767	.000167	.....	.....	
27,500	55,000	.001933	.000166	.....	.....	
30,000	60,000	.002133	.000200	0.	.....	
30,500	61,000	.002167	.000034	.....	.....	
31,000	62,000	.002200	.000033	.....	.....	
31,500	63,000	.002233	.000033	.....	.....	
32,000	64,000	.002267	.000034	.....	.....	
32,500	65,000	.010667	.008400	.....	.....	
33,000	66,000	.010800	.000133	.....	.....	
33,500	67,000	.010933	.000133	.....	.....	
34,000	68,000	.011167	.000234	.....	.....	
34,500	69,000	.011467	.000300	.....	.....	
35,000	70,000	.011667	.000200	.....	.....	
36,000	72,000	.012467	.000800	.....	.....	
37,000	74,000	.013167	.010700	.....	.....	
38,000	76,000	.013867	.000700	.....	.....	
39,000	78,000	.014533	.000666	.....	.....	
40,000	80,000	.015267	.000734	.....	.....	
64,830	129,640	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

No. 1060.

Mark, H.  
 Length, 4".  
 Diameter, ".798.  
 Sectional area, .50 square inch.  
 Gauged length, 3".

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
500	1,000	0.	0.	0.	0.	Initial load.
5,000	10,000	.000367	.000367	0.	.....	
10,000	20,000	.000900	.000433	.....	.....	
15,000	30,000	.001133	.000333	.....	.....	
20,000	40,000	.001433	.000300	0.	.....	
22,500	45,000	.001600	.000167	.....	.....	
25,000	50,000	.001733	.000133	.....	.....	
27,500	55,000	.001867	.000134	.....	.....	
30,000	60,000	.002000	.000133	0.	.....	
30,500	61,000	.002033	.000033	.....	.....	
31,000	62,000	.002067	.000034	.....	.....	
31,500	63,000	.002100	.000033	.....	.....	
32,000	64,000	.002100	0.	.....	.....	
32,500	65,000	.005500	.003400	.....	.....	
33,000	66,000	.006667	.001167	.....	.....	
33,500	67,000	.011167	.004500	.....	.....	
34,000	68,000	.011300	.000133	.....	.....	
34,500	69,000	.011467	.000167	.....	.....	
35,000	70,000	.011667	.000200	.....	.....	
36,000	72,000	.012200	.000533	.....	.....	
37,000	74,000	.012867	.000667	.....	.....	
38,000	76,000	.013633	.000766	.....	.....	
39,000	78,000	.014300	.000867	.....	.....	
40,000	80,000	.015167	.000867	.....	.....	
67,380	184,720	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

SPECIMENS TURNED DOWN FROM A BAR 2 INCHES + DIAMETER,  
FROM THE MIDVALE STEEL COMPANY.

No. 4692.

Mark, M.  
Diameter, ".564.  
Sectional area, .25 square inch.  
Gauged length, 2".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
250	1,000	0.000100	0.000100	0.	0.	
1,250	5,000	.000350	.000250	0.		
2,500	10,000	.000600	.000250			
5,000	20,000	.001000	.000400			
7,500	30,000	.001400	.000400			
10,000	40,000	.001850	.000150	0.		
11,250	45,000	.001750	.000200			
12,500	50,000	.001850	.000200			
15,000	60,000	.002100	.000150	.000050	.000050	
16,250	65,000	.002300	.000200			
17,500	70,000	.002500	.000200	.000050	0.	
17,750	71,000	.002550	.000050			
18,000	72,000	.002600	.000050			
17,000	68,000	.007500	.004800			
17,250	69,000	.008450	.000850			
17,500	70,000	.009400	.000950			
17,750	71,000	.009850	.000150			
18,000	72,000	.009950	.000400			
18,250	73,000	.010150	.000200			
18,500	74,000	.010550	.000400			
18,750	75,000	.010950	.000400			
19,000	76,000	.011450	.000550			
19,250	77,000	.011700	.000250			
19,500	78,000	.012250	.000550			
19,750	79,000	.012600	.000350			
20,000	80,000	.013150	.000550	.009350	.009300	
82,420	130,480					Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	130,480
Elastic limit per square inch of original section	do.	72,000
Elongation per inch after rupture	inch	.0550
Elongation per inch under strain at elastic limit	do.	.002600
Reduction in diameter at point of rupture	do.	.024
Reduction in area after rupture, per cent of original section		8.4
Position of rupture		at neck
Character of broken surface		fine granular
Elongation of inch sections		".06", ".05

Chemical composition.

Total carbon	Per cent.	0.836
Graphitic carbon		0.009
Combined carbon		0.927
Manganese		0.488
Silicon		0.288
Sulphur		0.008
Phosphorus		0.006

No. 1061.

Mark, M.  
 Length, 4".  
 Diameter, ".798.  
 Sectional area, .50 square inch.  
 Gauged length, 3".

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
500	1,000	0.	0.	0.	0.	Initial load.
5,000	10,000	.000367	.000367	0.	.....	
10,000	20,000	.000787	.000400	.....	.....	
15,000	30,000	.001033	.000266	.....	.....	
20,000	40,000	.001867	.000324	.000033	.000033	
22,500	45,000	.001533	.000166	.....	.....	
25,000	50,000	.001667	.000134	.000033	0.	
27,500	55,000	.001867	.000200	.....	.....	
30,000	60,000	.002000	.000133	.000033	0.	
32,500	65,000	.002167	.000167	.....	.....	
35,000	68,000	.002200	.000033	.....	.....	Elastic limit.
38,500	67,000	.002833	.000633	.....	.....	
34,000	68,000	.003233	.000400	.....	.....	
34,500	69,000	.006667	.003434	.....	.....	
35,000	70,000	.009000	.002333	.....	.....	
36,000	72,000	.009500	.000500	.....	.....	
37,000	74,000	.010067	.000567	.....	.....	
38,000	76,000	.010867	.000800	.....	.....	
39,000	78,000	.011667	.000800	.....	.....	
71,040	142,080	.012600	.000933	.....	.....	Ultimate strength.

Failed by triple flexure.

No. 1062.

Mark, M.  
 Length, 4".  
 Diameter, ".798.  
 Sectional area, .50 square inch.  
 Gauged length, 3".

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
500	1,000	0.	0.	0.	0.	Initial load.
5,000	10,000	.000367	.000367	0.	.....	
10,000	20,000	.000733	.000366	.....	.....	
15,000	30,000	.001067	.000334	.....	.....	
20,000	40,000	.001400	.000333	0.	.....	
22,500	45,000	.001533	.000133	.....	.....	
25,000	50,000	.001700	.000167	.....	.....	
27,500	55,000	.001867	.000167	.....	.....	
30,000	60,000	.002033	.000166	.000033	.000033	
32,500	65,000	.002167	.000134	.....	.....	
33,000	66,000	.002233	.000166	.....	.....	Elastic limit.
33,500	67,000	.002667	.000334	.....	.....	
34,000	68,000	.003133	.000466	.....	.....	
34,500	69,000	.004167	.001034	.....	.....	
35,000	70,000	.010233	.000066	.....	.....	
36,000	72,000	.010467	.000234	.....	.....	
37,000	74,000	.010933	.000466	.....	.....	
38,000	76,000	.011500	.000567	.....	.....	
39,000	78,000	.012500	.001000	.....	.....	
40,000	80,000	.013167	.000667	.....	.....	
69,620	139,240	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.



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# INITIAL STRAINS

IN

12-INCH TUBE AND JACKET AND STEEL RINGS.

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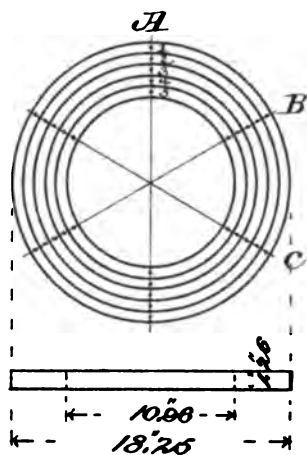




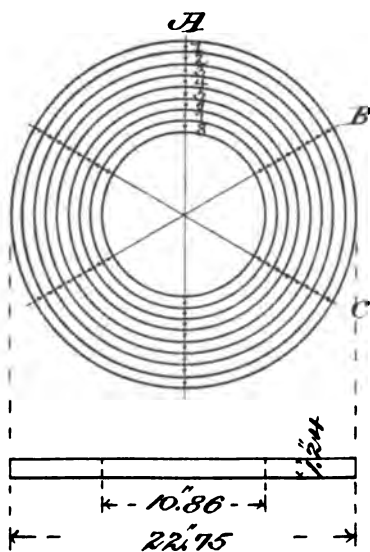
# 12-inch B. L. Rifle.

## Tube

*Muzzle end.*



*Breech end.*



No. 5476.

12-INCH TUBE.

MUZZLE END.

Marks, 12 R, T  
M T E

Ring.	Diameters.				Corresponding stress per square inch	
	A.	B.	C.	Mean	Tension.	Compression.
No. 1. In slice .....	<i>Inch.</i> 17. 5259	<i>Inch.</i> 17. 5219	<i>Inch.</i> 17. 4832	<i>Inch.</i> 17. 51033	<i>Pounds.</i>	<i>Pounds.</i>
No. 1. Detached .....	17. 5209	17. 5224	17. 4791	17. 50947		
	+ .0010	+ .0005	-. 0041	-. 00086	1473	
No. 2. In slice .....	16. 0441	16. 0171	16. 0230	16. 02807		
No. 2. Detached .....	16. 0450	16. 0167	16. 0228	16. 02817		
	+ .0009	-. 0004	-. 0002	+ .00010		187
No. 3. In slice .....	14. 5550	14. 5483	14. 5575	14. 55360		
No. 3. Detached .....	14. 5559	14. 5463	14. 5573	14. 55313		
	+ .0009	-. 0021	-. 0002	-. 00047	969	
No. 4. In slice .....	13. 0525	13. 0479	13. 0285	13. 04297		
No. 4. Detached .....	13. 0530	13. 0474	13. 0270	13. 04247		
	+ .0005	-. 0005	-. 0015	-. 00050	1150	
No. 5. In slice .....	11. 6313	11. 6481	11. 6358	11. 6384		
No. 5. Detached .....	11. 6323	11. 6494	11. 6359	11. 6392		
	+ .0010	+ .0013	+ .0001	+ .0008		2062

## INITIAL STRAINS.

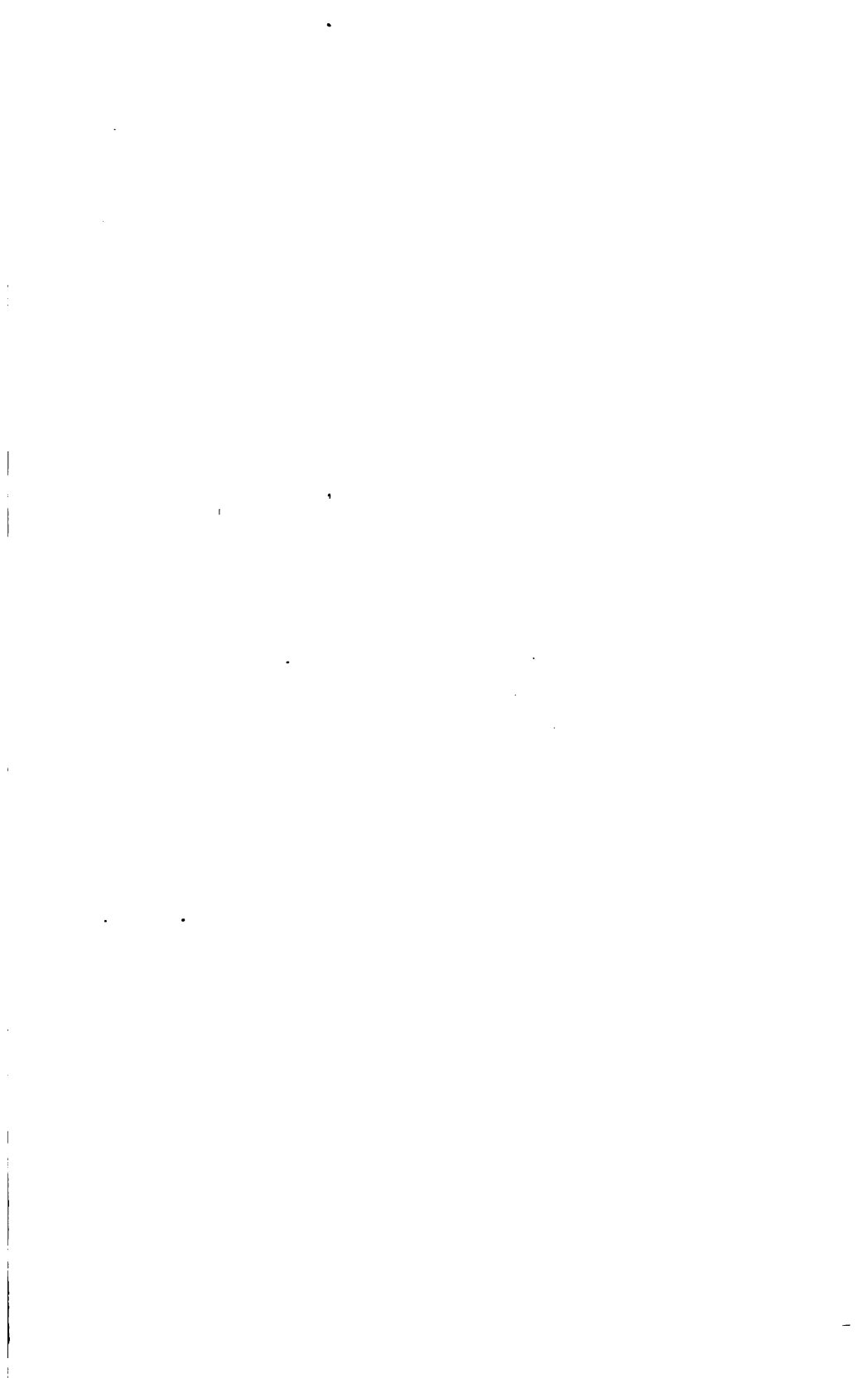
No. 5475.

## 12-INCH TUBE.

## BREECH END.

Marks, <sup>12 R, T</sup>  
B T E

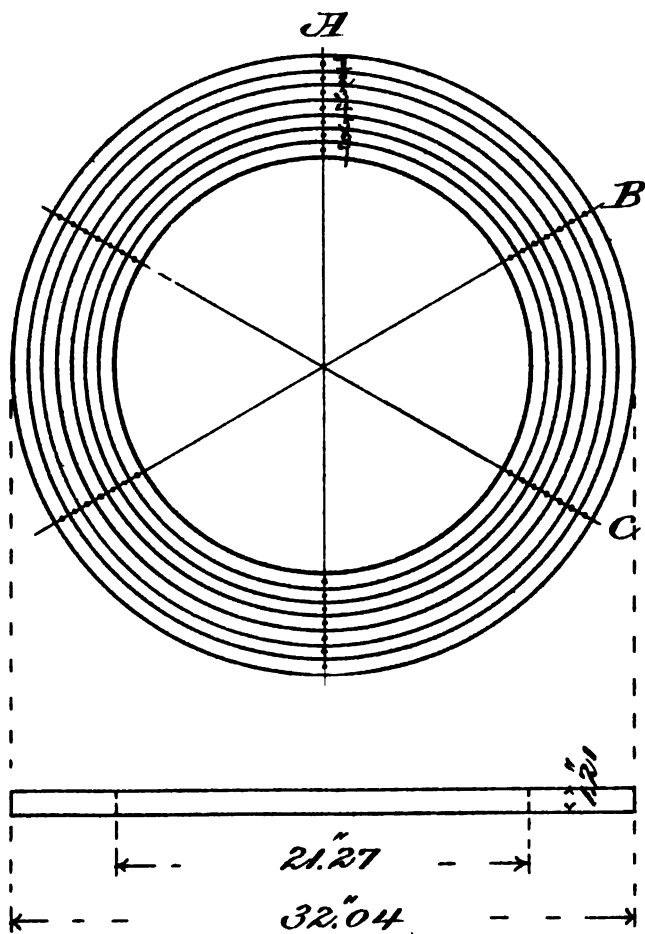
Ring.	Diameters.				Corresponding stress per square inch.	
	A.	B.	C.	Mean.	Tension.	Compression.
No. 1. In slice .....	<i>Inch.</i> 22.0973	<i>Inch.</i> 22.1083	<i>Inch.</i> 22.0690	<i>Inch.</i> 22.0920	<i>Pounds.</i>	
No. 1. Detached .....	22.0908	22.1106	22.0847	22.09737		
	-.0005	+.0023	-.0043	.00083	1126	
No. 2. In slice .....	20.5519	20.5690	20.5550	20.55793		
No. 2. Detached .....	20.5514	20.5665	20.5565	20.55813		
	-.0005	+.0005	+.0006	+.00020		291
No. 3. In slice .....	19.0322	19.0562	19.0423	19.04256		
No. 3. Detached .....	19.0320	19.0563	19.0396	19.04263		
	-.0002	+.0001	-.0027	-.00093	1165	
No. 4. In slice .....	17.4969	17.5030	17.4963	17.49673		
No. 4. Detached .....	17.4963	17.5024	17.4957	17.49613		
	-.0006	-.0006	-.0006	-.00060	1028	
No. 5. In slice .....	15.9738	15.9557	15.9590	15.96283		
No. 5. Detached .....	15.9730	15.9554	15.9590	15.96247		
	-.0008	-.0003	.0000	-.00036	676	
No. 6. In slice .....	14.4879	14.4873	14.4858	14.48033		
No. 6. Detached .....	14.4906	14.4705	14.4835	14.48320		
	+.0027	+.0032	+.0027	+.00287		5946
No. 7. In slice .....	12.9879	12.9495	12.9749	12.97077		
No. 7. Detached .....	12.9870	12.9489	12.9765	12.97080		
	-.0009	-.0006	+.0016	+.00003		60
No. 8. In slice .....	11.4715	11.4811	11.4721	11.47490		
No. 8. Detached .....	11.4715	11.4814	11.4723	11.47507		
	.0000	+.0003	+.0003	+.00017		444



# *12-inch B.L. Rifle.*

## *Jacket*

*Muzzle end.*





No. 5474.

## 12-INCH JACKET.

## MUZZLE END.

Marks, 12 R, J  
M T R

Ring.	Diameters.				Corresponding stress per square inch.	
	A.	B.	C.	Mean.	Tension	Compression.
	Inch.	Inch.	Inch.	Inch.	Pounds.	Pounds.
No. 1. In slice .....	31. 2176	31. 2485	31. 2877	31. 25127		
No. 1. Detached .....	32. 2157	31. 2448	31. 2952	31. 25190		
	- .0019	- .0087	+ .0075	+ .00063		605
No. 2. In slice .....	29. 6310	29. 6772	29. 6582	29. 66547		
No. 2. Detached .....	29. 6307	29. 6776	29. 6599	29. 66307		
	- .0003	+ .0004	+ .0017	+ .00060		606
No. 3. In slice .....	28. 1063	28. 1168	28. 1118	28. 11163		
No. 3. Detached .....	28. 1126	28. 1141	28. 1009	28. 10953		
	+ .0073	- .0027	- .0109	- .00210	2241	
No. 4. In slice .....	26. 5510	26. 5609	26. 5458	26. 55253		
No. 4. Detached .....	26. 5442	26. 5632	26. 5500	26. 55246		
	- .0068	+ .0024	+ .0042	- .00007	79	
No. 5. In slice .....	25. 0334	25. 0371	25. 0501	25. 04020		
No. 5. Detached .....	25. 0349	25. 0328	25. 0511	25. 03943		
	+ .0015	- .0048	+ .0010	- .00077	922	
No. 6. In slice .....	23. 5248	23. 4963	23. 5102	23. 51042		
No. 6. Detached .....	23. 5296	23. 4991	23. 5064	23. 51167		
	+ .0047	+ .0028	- .0038	+ .00124		1582
No. 7. In slice .....	21. 9737	21. 9628	21. 9661	21. 96758		
No. 7. Detached .....	21. 9716	21. 4651	21. 9676	21. 96810		
	- .0021	+ .0028	+ .0015	+ .00067		778

No. 5473.

## 12-INCH JACKET.

## BREECH END.

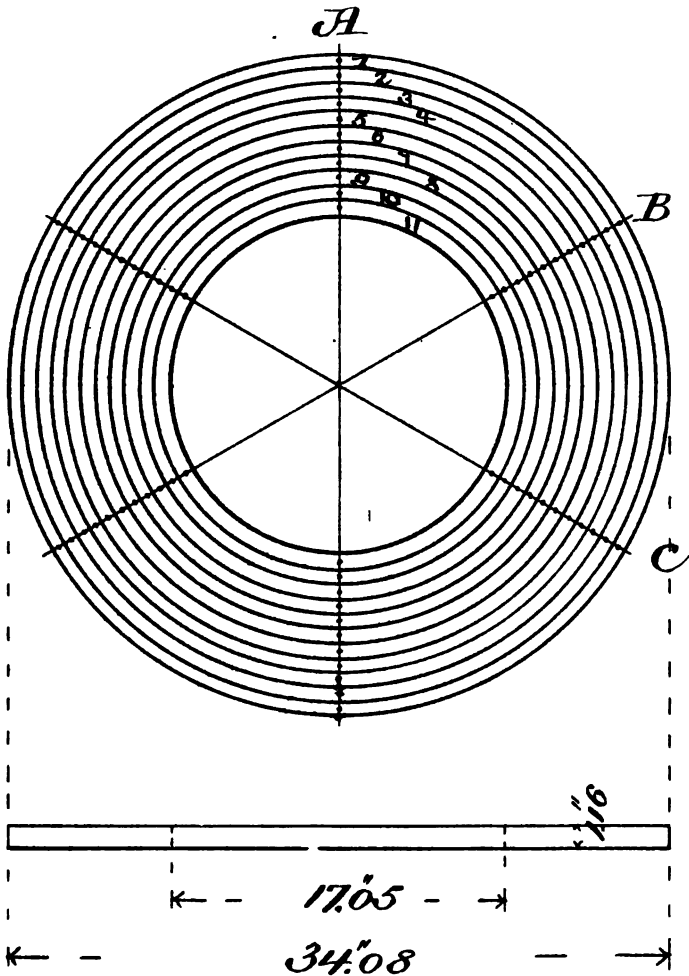
Marks, <sup>12 R J</sup>  
B T R

Ring.	Diameters.				Corresponding stress per square inch.	
	A.	B.	C.	Mean.	Tension.	Compression.
	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Pounds.</i>	<i>Pounds.</i>
No. 1. In slice .....	33.4203	33.4240	33.4258	33.4237		
No. 1. Detached .....	33.4213	33.4230	33.4230	33.4233		
	+ .0010	— .0007	— .0028	— .00084	753	
No. 2. In slice .....	31.8921	31.8648	31.8670	31.87463		
No. 2. Detached .....	31.8945	31.8667	31.8630	31.87440		
	+ .0024	— .0019	— .0050	— .00023	316	
No. 3. In slice .....	30.3971	30.3637	30.3645	30.37510		
No. 3. Detached .....	30.3972	30.3641	30.3629	30.37473		
	+ .0001	+ .0004	— .0016	— .00037	365	
No. 4. In slice .....	28.8524	28.8350	28.8391	28.84217		
No. 4. Detached .....	28.8489	28.8354	28.8394	28.84123		
	— .0035	+ .0004	+ .0003	— .00094	977	
No. 5. In slice .....	27.8106	27.2933	27.2966	27.30013		
No. 5. Detached .....	27.8079	27.2938	27.2961	27.29927		
	— .0026	+ .0005	— .0005	— .00086	945	
No. 6. In slice .....	25.8320	25.8205	25.7922	25.81523		
No. 6. Detached .....	25.8306	25.8197	25.7930	25.81443		
	— .0014	— .0008	— .0002	— .00080	929	
No. 7. In slice .....	24.2087	24.2040	24.2034	24.20370		
No. 7. Detached .....	24.2038	24.2060	24.2008	24.20353		
	+ .0001	+ .0020	— .0026	— .00017	210	
No. 8. In slice .....	22.6263	22.6134	22.5634	22.60103		
No. 8. Detached .....	22.6267	22.6140	22.5620	22.60090		
	+ .0004	+ .0006	— .0014	— .00013	172	
No. 9. In slice .....	21.0830	21.0660	21.0704	21.07313		
No. 9. Detached .....	21.0834	21.0623	21.0751	21.07360		
	+ .0004	— .0037	+ .0047	+ .00047		669
No. 10. In slice .....	19.5296	19.5296	19.5180	19.52573		
No. 10. Detached .....	19.5320	19.5280	19.5239	19.52730		
	+ .0024	— .0036	+ .0069	+ .00157		2412
No. 11. In slice .....	17.9750	18.0063	17.9575	17.9796		
No. 11. Detached .....	17.9774	18.0009	17.9602	17.9796		
	+ .0024	— .0054	+ .0027	— .0001	167	

*12-inch B. L. Rifle.*

*Jacket*

*Breech end.*

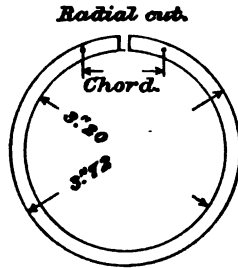




## INITIAL STRAINS.

## TESTS TO DETERMINE THE EFFECTS OF TURNING OFF HEAVY CHIPS ON THE INTRODUCTION OF INITIAL STRAINS IN STEEL RINGS.

No. 5454.

Length of ring,  $''$ .85.

A chord about  $1''$ .300 was measured and then the ring cut a part radially midway the extremities of the measured chord.

The cut allowed the chord to shorten  $''$ .0002; hence very slight strains were released.

Next, putting the ring on a face plate of a lathe and clamping it in position by means of a central disk and bolt, the outside diameter of the ring was turned down with one heavy cut and coarse feed, from  $3''$ .72 diameter to  $3''$ .54— $''$ .09 thickness of metal on a side being turned off.

Again measuring the chord, it was found  $''$ .0010 longer than originally laid off.

No. 5455.

Length of ring,  $''$ .85.Exterior diameter,  $3''$ .71.Interior diameter,  $3''$ .20.A chord about  $1''$ .3 long laid off same as in test 5454.

Measured chord before and after cutting apart radially midway the chord; the effect of cutting was to lengthen the chord measurement  $''$ .0009.

No. 5456.

Length of ring,  $''$ .85.Exterior diameter,  $3''$ .70.Interior diameter,  $3''$ .20.

Ring was cut apart radially and chord measured across the cut; a chip was then turned off, reducing the exterior diameter to  $3''$ .53.

The chord was again measured and it was found that turning off the outside chip caused the chord measurement to enlarge  $''$ .0024.

No. 5457.

Length of ring,  $''$ .85.Exterior diameter,  $3''$ .70.Interior diameter,  $3''$ .20.

Ring carefully annealed and cut apart radially.

Chord measured across the cut, and ring turned out on inside with one chip to  $3''$ .34 diameter.

Effect of taking off chip from inside was to diminish the chord measurement  $''$ .058.



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**10-INCH WIRE WRAPPED WOODBRIDGE B. L. RIFLE.**

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**HYDROSTATIC TEST OF INNER STAVE RING.**

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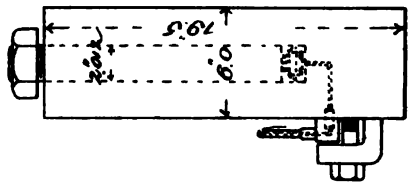
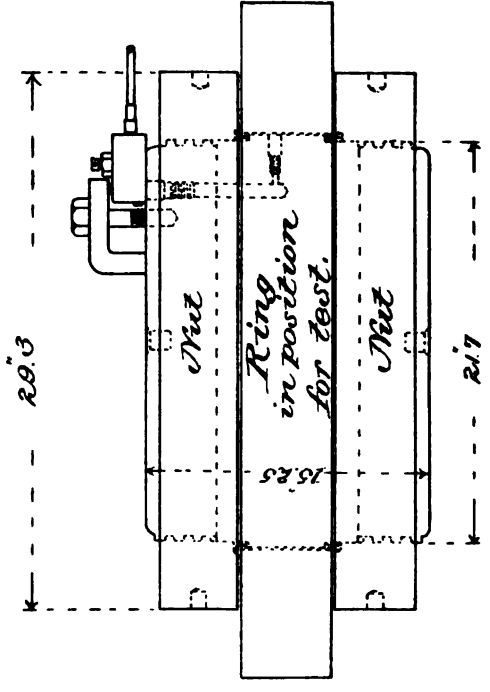
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*Apparatus for applying hydrostatic pressure to Inner stave ring, 10-inch w. w. Wood bridge gun.*



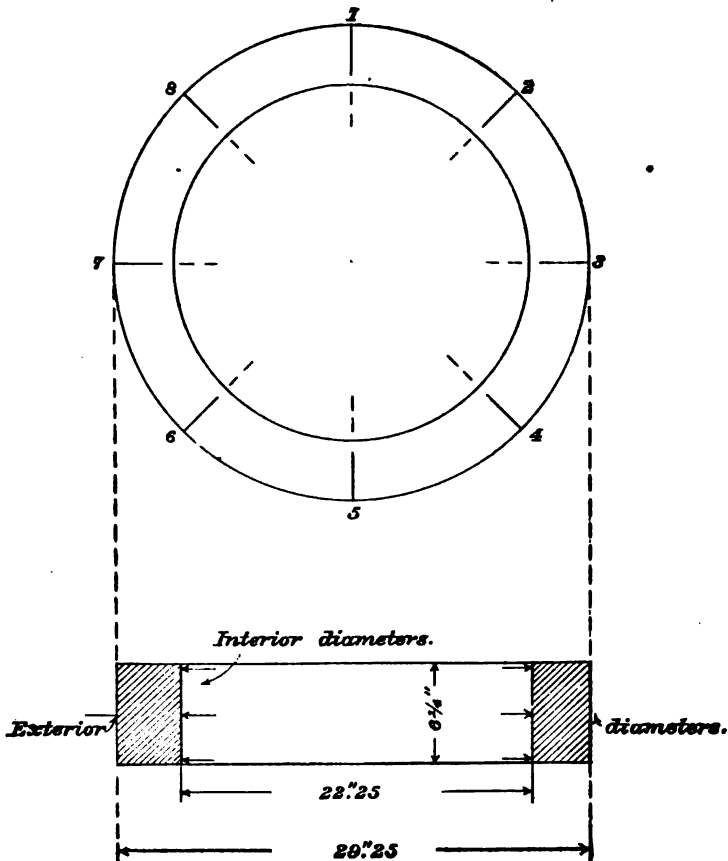
*Reservoir*

# 10-INCH WIRE WRAPPED WOODBRIDGE B. L. RIFLE.

## INNER STAVE RING.

[Experiments made under the direction and with apparatus designed by Dr. W. E. Woodbridge.]

The ring was subjected to interior hydrostatic pressure by means of the apparatus herewith illustrated, and measurements showing expansion of diameters taken while the ring was under pressure, and permanent sets observed after the release of loads.



The measurements included surface diameters over the exterior of the ring, diameters at the middle of the thickness, and those near the interior surface; the latter being taken about ".10 from the surface of the bore.

The diameters at the middle of the thickness, and near the surface of the bore, were taken by means of pins inserted into small drilled holes in the ring which penetrated to the required depth. The inner ends of the pins rested against the metal of the ring at the bottom of the holes, while the outer ends projected beyond the exterior diameter, and were thus accessible to the calipers.

Exterior diameters were also measured with pins having collars which rested against the ring around the small drilled holes.

The interior pressures per square inch were assumed to be the total load applied by the testing machine to the piston of the reservoir divided by the area of the piston.

The tables show the amount of expansion measured on each diameter under the indicated pressures and the amount of permanent sets when the pressures were released.

The original diameters of the ring to which the recorded expansions refer were as follows:

Exterior surface.....	29.52
Near middle of thickness of ring.....	25.75
Near interior surface of ring.....	22.45

It will be observed that the total expansion under what was apparently 15,000 pounds per square inch was less than the recorded expansion under 14,000 pounds per square inch. The condition of the straining apparatus was such as to possibly explain the anomalous action of the ring.

Difficulty had been experienced with the hydraulic packings; excessive leakage occurred. In order to check the rapid leakage at the packings, ground ginger root and wood pulp had been introduced to the reservoir with the water used in charging the apparatus, and it is believed that the material thus introduced occasioned a partial or complete sealing of the pressure before it reached the ring, and the maximum pressure of the reservoir failed at the time to reach the interior surface of the ring.

TABLE SHOWING EXPANSION OF INNER STAVE RING UNDER PRESSURE AND PERMANENT SETS.

Interior pressure per square inch.	Expansion of ring.											
	Diameters 1-5.			Diameters 2-6.			Diameters 3-7.			Diameters 4-8.		
	Exterior surface with pins.	Near interior surface of ring.	Successive.	Exterior surface with pins.	Near middle of thickness of ring.	Successive.	Exterior surface with pins.	Near interior surface of ring.	Successive.	Exterior surface with pins.	Near middle of thickness of ring.	Successive.
0	Total.	Inch.	0.	Total.	Inch.	0.	Total.	Inch.	0.	Total.	Inch.	0.
2,000		.0075	.0086		.0081	.0088		.0083	.0085		.0077	.0083
4,000		.0105	.0113		.0033	.0113		.0031	.0114		.0077	.0112
5,000		.0133	.0028		.0142	.0028		.0031	.0145		.0110	.0053
6,000		.0160	.0027		.0181	.0028		.0031	.0173		.0138	.0028
7,000		.0189	.0029		.0212	.0031		.0028	.0191		.0170	.0032
8,000		.0092	.0002		.0200	.0029		.0027	.0221		.0198	.0028
		.0002	.0008		.0008	.0007		.0007	.0010		.0002	.0005
12,000		.0324	.0135		.0348	.0146		.0208	.0445		.0384	.0148
13,000		.0016	.0037		.0019	.0035		.0063	.0081		.0057	.0055
		.0389	.0085		.0482	.0112		.0068	.0909		.0529	.0068
0		.0074	.0068		.0122	.0085		.0198	.0164		.0145	.0144
14,000		.0819	.0837		.0871	.0405		.0528	.1110		.0478	.0501
0		.0437	.0825		.0497	.0462		.0591	.0670		.0421	.0589
		.0237	.0431		.0458	.0431		.0591	.0670		.0478	.0589
0		.0291	.0040		.0458	.0001		.0610	.0684		.0460	.0018
		.0040	.0404		.0043	.0498		.0019	.0014		.0018	.0007
		.0007	.0007		.0007	.0007		.0007	.0007		.0007	.0007

RING REMOVED FROM STRAINING APPARATUS.

0	.0291	.0040	.0404	.0043	.0498	.0001	.0610	.0684	.0014	.0018	.0007
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This pressure applied four times, rapid leakage preventing micrometer readings being taken at the time.

PERMANENT EXPANSION OF INTERIOR OF RING.

[The diameters correspond to those which had been taken at the exterior of the same numbers.]

Interior pressure per square inch.	Diameters 1-5.			Diameters 2-4.			Diameters 3-7.			Diameters 4-8.		
	Top end of ring.	Middle of length.	Bottom end of ring.	Top end of ring.	Middle of length.	Bottom end of ring.	Top end of ring.	Middle of length.	Bottom end of ring.	Top end of ring.	Middle of length.	Bottom end of ring.
Pounds. 0	Inch. .0086	Inch. .0404	Inch. .0775	Inch. .0210	Inch. .0542	Inch. .0836	Inch. .0336	Inch. .0675	Inch. .1060	Inch. .0211	Inch. .0554	Inch. .0932

RING RETURNED TO THE STRAINING APPARATUS.

Expansion of ring.

Interior pressure per square inch.	Diameters, 1-5.						Diameters, 2-4.						Diameters, 3-7.						Diameters, 4-8.					
	Exterior surface with pins.			Near interior surface of ring.			Exterior surface of ring.			Near middle of thickness of ring.			Exterior surface with pins.			Near interior surface of ring.			Exterior surface with pins.			Near middle of thickness of ring.		
	Total.	Successive.	Inch.	Total.	Successive.	Inch.	Total.	Successive.	Inch.	Total.	Successive.	Inch.	Total.	Successive.	Inch.	Total.	Successive.	Inch.	Total.	Successive.	Inch.	Total.	Successive.	Inch.
Pounds. 14,000	.0874	.0333	.0887	.0463	.0840	.0332	.0840	.0332	.0840	.0332	.0840	.0332	.0840	.0332	.0840	.0332	.0840	.0332	.0840	.0332	.0840	.0332	.0840	.0332
15,000	.0823	.0351	.0749	.0118	.0800	.0340	.0800	.0340	.0800	.0340	.0800	.0340	.0800	.0340	.0800	.0340	.0800	.0340	.0800	.0340	.0800	.0340	.0800	.0340
16,000	.0460	.0166	.0594	.0190	.0673	.0215	.0673	.0215	.0673	.0215	.0673	.0215	.0673	.0215	.0673	.0215	.0673	.0215	.0673	.0215	.0673	.0215	.0673	.0215
0.																								

Ring removed from straining apparatus.

TOTAL EXPANSION OF INTERIOR OF RING.

Interior pressure per square inch.	Diameters, 1-5.			Diameters, 2-6.			Diameters, 3-7.			Diameters, 4-8.		
	Top end of Ring.	Middle of length.	Bottom end of ring.	Top end of Ring.	Middle of length.	Bottom end of ring.	Top end of Ring.	Middle of length.	Bottom end of ring.	Top end of Ring.	Middle of length.	Bottom end of ring.
Pounds. 0	Inch. .0086	Inch. .0587	Inch. .1123	Inch. .0285	Inch. .0780	Inch. .1350	Inch. .0413	Inch. .0903	Inch. .1464	Inch. .0238	Inch. .0727	Inch. .1277

**PERMANENT EXPANSION OF EXTERIOR SURFACE OF RING AFTER BEING STRAINED BY PRESSURES RECORDED IN TABLE.**

[Measurements taken after loads were released.]

After interior pressure per square inch of—	Permanent sets.			
	Diameters.			
	1-5.	2-6.	3-7.	4-8.
<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>
8,000	.0007	.0010	.0014	.0010
12,000	.0022	.0028	.0037	.0031
14,000	.0333	.0437	.0533	.0435
	Ring removed from straining fixture.			
	.0296	.0430	.0513	.0473
	Again placed on straining fixture.			
16,000	.0471	.0679	.0810	.0653



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# **HARDENED AND TEMPERED STEEL.**

**TRANSVERSE AND TENSION TESTS.**

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## HARDENED AND TEMPERED STEEL.

These experiments were undertaken preliminary to the manufacture of Belleville springs for 12-inch B. L. rifled mortar spring return carriages, to aid in the selection of a suitable material and determining the proper treatment in tempering.

Experimental springs were made from plates  $\frac{7}{16}$ " in. thickness.

These tempered strips were from the same plates; they were the full thickness of the plates and were planed out in widths from about  $\frac{1}{8}$ " to  $\frac{7}{8}$ ", according as the material permitted, after first having cut out disks for springs.

Five grades of plate steel were experimented with, and a number of experiments made with some spring steel bars in store at the arsenal.

The details of the tempering process were varied; hardening the strips, which were heated to different temperatures, by quenching in different baths at different temperatures. The temperature at which the temper was drawn was also varied.

In defining the temperatures of drawing the temper, the color full blue, refers to that shade when a deep or intense shade of blue was reached.

Raising the temperature, next imparts a shade of light blue, above which the color of the metal does not afford a reliable indication of the temperature until the steel becomes red hot.

After drawing the temper the strips were immediately cooled in oil.

In so wide a field of research as the tempering of steel, a comparatively small number of experiments can hardly do more than furnish indications of what range in physical properties might be expected.

In the present experiments certain well defined results were produced, and to these attention will be called, reserving, however, more extended remarks and discussion of results until a comprehensive series of experiments in progress are completed.

In general, it appears from these preliminary experiments that heating and quenching in baths of comparatively slow action may cause decided increase in strength over the steel in its natural state as rolled or hammered plate, and the metal may be characterized by toughness without subsequent drawing of the temper.

While the metal may in this manner have its strength increased to a certain extent, yet more energetic hardening followed by drawing the temper has produced higher results.

The maximum transverse strength attained has been in those cases where the metal was first brought to a state of full hardness.

While in the state of full hardness the metal was very brittle and apparently in a weakened condition. Upon drawing the temper the metal displayed great strength, at first accompanied by brittleness, but as the temperature of drawing was increased it regained toughness and at the same time lost in transverse strength.

This behavior suggests the explanation that although apparently weak when in a state of intense hardness, the metal may then in reality be in its strongest condition, the apparent weakness being due to internal strains assisting the external force applied in causing ruptures, moderate heating relieving the hardening strains and destroying the tendency to rupture from within the metal.

The minimum quenching temperature, sudden cooling from below which did not sensibly increase the transverse strength, appeared to vary with the different grades of steel.

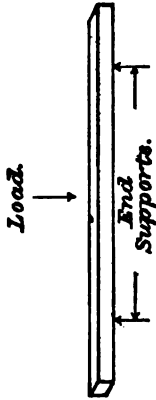
Certain strips were very susceptible to hardening cracks. This was observed with the steels of 1.04 per cent and 1.25 per cent manganese. When hardening the Belleville springs this tendency to crack was more conspicuous than in the case of the small strips.

The range of temperature from which full hardness could be given the high manganese steel without cracking was very limited. Great strength was reached, accompanied, however, by brittleness.

The high silicon steel showed no unusual features attributable to its chemical composition.

The size of the piece influences the manner of treatment. Oil quenching was sufficiently energetic for the strips, whereas water quenching seemed necessary for the springs, which further emphasizes the influence of initial hardness before the temper is drawn.

**TEMPERED STEEL STRIPS. BELLEVILLE SPRINGS EXPERIMENTAL METAL.**  
**TEMPERING TREATMENT AND TRANSVERSE TESTS.**



**SPECIMENS FROM BESSEMER PLATE MARKED 4.**

[Chemical composition: Carbon, .47; manganese, .020; silicon, .363. End supports 8" apart.]

No. of test.	Treatment.		Dimensions.			Ultimate strength.		Fracture.	
	Color heated to—	Hardened in— Fluid.	Temper drawn at—	Temper- ature.	Breadth.	Depth.	Total.		Maximum fiber stress.
126	Bright red.....	Water.....	Not drawn.....	200	.326	.447	1,240	228,920	Rapid yielding at 800 pounds. Bent 15° then fractured. Silky.
127	do.....	do.....	Full blue.....	80	.340	.454	1,576	270,170	Bent about 2° then fractured. Fine granular.
128	do.....	do.....	do.....	50	.424	.448	1,906	274,120	No appreciable permanent bend. Fine granular.
131	do.....	do.....	do.....	103	.346	.454	1,438	251,490	Do.
130	do.....	do.....	Light blue.....	50	.435	.448	2,848	339,540	Do.
145	do.....	Oil.....	Not drawn.....	60	.3405	.4528	1,142	193,330	Bent 57° without fracture.
130	do.....	do.....	do.....	60	.322	.443	1,015	183,330	Rapid yielding at 700 pounds. Bent 81° without fracture.
144	do.....	do.....	Deep purple.....	60	.3136	.4444	1,008	195,250	Bent 48° without fracture.
143	do.....	do.....	Full blue.....	61	.338	.453	1,252	216,800	Bent 65° without fracture.
143	do.....	do.....	Nearly light blue.....	60	.314	.450	1,140	215,430	Bent 54° then fractured. Silky 50 per cent; granular 50 per cent.

SPECIMENS FROM BESEMER PLATE MARKED 8.

[Chemical composition: Carbon, .47; manganese, .620; silicon, .363. End supports 8" apart.]

No. of test.	Color heated to—		Treatment.		Dimensions.		Ultimate strength.		Fracture.
	Natural state	Temper-ature.	Fluid.	Temper drawn at—	Depth.		Total.	Maximum fiber stress.	
					Inch.	Inch.			
132	Natural state	o F.							
131	Full cherry	170	Water	Not drawn	.424	.4525	1,070	132, 150	Rapid yielding at 450 pounds. Bent 70° then fractured. Silky 40 per cent on tension side, granular 60 per cent on com-
134	Bright red	180	do	do	.380	.453	1,246	147, 760	pression side.
135	Full cherry	180	do	Not drawn, hammered	.418	.447	1,494	192, 920	Bent 85° without fracture.
138	Low cherry	178	do	do				214, 610	Bent 25°. Silky.
133	Bright red	178	do	Light blue	.416	.4472	984	118, 080	Do.
134	do	178	do	Full blue	.325	.4425	1,295	217, 430	Bent 60° without fracture.
135	do	163	do	do	.325	.442	1,049	192, 180	Bent 18° then fractured. Fine granular.
136	do	160	do	do	.325	.445	1,308	228, 530	Bent 70° without fracture.
137	do	160	do	do	.325	.445	1,354	228, 530	Bent 45° then fractured.
138	do	160	do	Light blue	.366	.4437	1,754	239, 180	Bent 19°. Silky 25 per cent, granular 75 per cent.
139	do	160	do	do	.404	.4504	2,048	237, 276	Brittle. Fine granular.
140	do	175	do	Above light blue	.375	.4575	1,838	226, 700	Bent 25°. Silky.
141	do	60	Oil	Light blue	.374	.4443	1,638	231, 100	Bent 41°. Silky 15 per cent, fine granular 85 per cent.
142	do	60	do	Above light blue	.407	.4425	1,560	234, 000	Bent 44°. Silky 80 per cent, granular 20 per cent.
143	Very bright red.	60	do	Light blue	.421	.444	1,735	254, 520	Bent 25°. Silky 5 per cent, granular 95 per cent.

SPECIMENS FROM BESEMER PLATE MARKED 5.

[Chemical composition: Carbon, .48; manganese, 1.25; silicon, .068. End supports 8" apart.]

148	Natural state	60	Water		.332	.406	724	159, 410	Bent 70° without fracture.
105	Bright red	do	do	Not drawn	.440	.414	445	71, 200	No perceptible permanent bend. Fine granular. Seam at middle of thickness, .30 deep.
109	Full blood red	105	do	Light blue	.351	.412	750	151, 280	Bent 60° without fracture.
153	Low cherry red.	175	do	do	.366	.411	560	103, 880	Fine granular. Hardening crack.
162	do	175	do	Above light blue	.346	.406	1,487	313, 050	Fine granular; brittle.

106	Bright red.....do.....	60	Deep straw.....	.428	.411	768	127, 120	No perceptible permanent bend. Fine granular. Seam at middle of thickness. Hardening crack $\frac{1}{16}$ deep from compression surface.
107	.....do.....do.....	60	Purple.....	.468	.417	995	146, 500	No perceptible permanent bend. Medium fine granular. Seam at middle of thickness $\frac{1}{16}$ deep.
108	.....do.....do.....	60	Full blue.....	.446	.411	1,305	207, 420	No perceptible permanent bend. Fine granular. Seam at middle of thickness $\frac{1}{16}$ deep.
109	Blood red.....Oil.....	60	Not drawn.....	.359	.410	805	160, 070	Bent 64° without fracture
109	Bright red.....do.....	60	.....do.....	.501	.4125	1,998	239, 720	No perceptible permanent bend. Fine granular. Triangular piece detached from compression side of bend.
164	Full blood red.....do.....	60	Light blue.....	.383	.410	805	150, 190	Bent 72° without fracture
163	Low cherry.....do.....	60	Above light blue.....	.450	.413	2,932	320, 820	Fine granular. Hardening crack.
164	Cherry red.....do.....	60	Light blue.....	.427	.407	1,982	237, 260	Fine granular.
170	Full cherry.....do.....	55	Above light blue.....	.319	.408	280, 300	280, 300	Fine granular, brittle.
110	Bright red.....do.....	60	Deep straw.....	.441	.4105	2,041	328, 750	Bent about 29°. Fine granular. Triangular piece detached from compression side of bend.
111	.....do.....do.....	60	Dark purple.....	.473	.410	1,516	243, 920	Bent about 29°. Medium fine granular. Triangular piece detached from compression side of bend.
112	.....do.....do.....	60	Light blue.....	.511	.4124	2,200	303, 450	Do.

SPECIMENS FROM BESSEMER PLATE MARKED 9.

[Chemical composition: Carbon, .46; manganese, 1.25; silicon, .068. End supports 8' apart.]

119	Bright red.....Oil.....	60	Purple.....	.367	.410	1,533	298, 930	No perceptible permanent bend. Fine granular. Triangular piece detached from compression side of bend.
120	.....do.....do.....	60	Full blue.....	.440	.409	1,924	314, 130	
121	.....do.....do.....	60	Light blue.....	.358	.405	1,446	236, 620	

The fourth strip taken from this plate was quenched in oil and split through the middle of the thickness of the plate a distance of 7". This crack occurred after quenching, and developed during the night. The strip was intact one and one-half hours after quenching and was found cracked in the morning, fourteen hours later.

SPECIMENS FROM BESEMER PLATE MARKED 2.

[Chemical composition: Carbon, .59; manganese, 1.04; silicon, .28. End supports 8" apart.]

No. of test.	Treatment.		Dimensions.			Ultimate strength.		Fracture.	
	Color heated to—	Hardened in— Fluid.	Temperatures.	Temper drawn at—	Breadth.	Depth.	Total.		Maximum fiber stress.
149	Natural state.								
148	Low cherry	Water.	105	Light blue	.350	.483	1,049	Bent 75° without fracture.	
151	Cherry red	Water.	157	do	.317	.451	988	Bent 45° without fracture.	
					.345	.454	1,064	Fine granular	
152	do	do	152	Light blue, twice	.369	.454	2,071	Fine granular.	
164	Flood red	Oil	60	Not drawn	.305	.453	1,183	Bent 55° without fracture.	
167	Low cherry	do	60	Light blue	.440	.438	1,262	Bent 55° without fracture.	
180	Cherry red	do	64	do	.423	.449	2,286	Fine granular	
					.352	.453	238,000	Medium fine granular.	

SPECIMENS FROM OPEN HEARTH PLATE MARKED 3.

[Chemical composition: Carbon, .60; manganese, .422; silicon, .105. End supports 8" apart.]

113	Bright red	Natural state.	147	Full blue	.475	.4518	1,284	Bent 60° without fracture.
138	do	Water.	152	do	.267	.451	1,320	Granular, brittle. Hardening crack.
141	do	Salt water.		do	.395	.449	1,500	Do.
140	do	Oil.	42	Not drawn	.304	.453	212,340	Bent 51° without fracture.
114	do	do	60	Light straw	.402	.4494	239,860	Bent 54° without fracture.
115	do	do	60	Straw to purple	.435	.450	238,780	Bent 49° without fracture.
116	do	do	60	Purple to blue	.469	.458	245,720	Bent 81° without fracture.
117	do	do	60	Full blue	.468	.448	243,060	Bent 69° without fracture.
139	do	do	47	do	.336	.446	231,560	Bent 59° without fracture.
118	do	do	60	Light blue	.390	.445	1,522	Bent 75° without fracture.



SPECIMENS FROM OPEN HEARTH PLATE MARKED 7.

[Chemical composition: Carbon, .60; manganese, .422; silicon, .108. End supports 8" apart.]

157	Cherry red	Water	177	Not drawn	.421	.455	1, 1,220	140,600	Bent 70° without fracture.
158	do	do	170	Light blue	.406	.452	1, 1,48	164,960	Bent 70° without fracture.
160	do	do	176	do	.353	.445	1, 1,645	164,520	Bent 75° without fracture.
125	Bright red	do	203	Not drawn	.387	.450	680	202,700	Rapid yielding began at 680 pounds.
122	do	do	50	Full blue	.388	.449	1, 1,110	197,200	No perceptible permanent bend.
124	do	do	200	do	.341	.448	1, 1,310	211,970	Hardening crack .75 wide along middle of thickness.
128	do	do	50	Light blue	.386	.448	1, 1,866	250,300	Medium fine granular.
174	do	do	170	Above light blue	.407	.470	2, 2,038	300,520	Rapid yielding began at 680 pounds.
181	do	do	180	do	.385	.452	1, 1,922	303,370	Bent 55° without fracture.
179	do	do	181	do	.389	.452	1, 1,726	283,720	Medium fine granular.
180	do	Salt water	182	do	.376	.451	1, 1,489	284,180	Hardening crack .45 wide along middle of thickness.
175	do	do	100	do	.341	.449	1, 1,914	384,080	Silky interpenetrated with fine granulation. Bent 30°. Two hardening cracks.
173	do	Oil	60	Light blue	.383	.450	1, 1,621	250,900	Fine granular. Bent 35°.
178	do	do	66	do	.384	.450	1, 1,638	252,810	Fine granular. Bent 30°. Silky. Bent 35°.

SPECIMENS FROM OPEN HEARTH PLATE MARKED 0.

[Chemical composition: Carbon, .70; manganese, .460; silicon, .127. End supports, 8" apart.]

171	Full cherry	Water	192	Light blue	.360	.443	1, 1,496	254,640	Coarse, granular, brittle. Hardening crack.
95	Bright red	do	60	Dark straw	.486	.445	2, 2,000	72,000	Medium fine granular. Bent 25°.
96	do	do	60	Purple to blue	.434	.4495	1, 1,912	125,070	No perceptible permanent bend. Fine granular.
97	do	do	60	Full blue	.418	.4455	689	100,220	No perceptible permanent bend. Fine granular. Hardening crack at corner on compression side.
98	do	do	60	Light blue	.360	.445	1, 1,215	194,400	No perceptible permanent bend. Medium fine granular. Seam at middle of thickness of plate.
159	Full cherry	Oil	90	do	.376	.442	2, 2,000	327,420	Fine granular. Bent
172	do	do	55	Above light blue	.353	.444	1, 1,980	341,870	Fine granular. Bent about 6°.
99	Bright red	do	60	Light straw	.428	.447	1, 1,252	175,720	Fine granular. No perceptible permanent bend.
100	do	do	60	Dark purple	.383	.425	1, 1,478	236,480	Do.
101	do	do	60	Purple to blue	.401	.445	1, 1,998	256,300	Bent 35° without fracture.
102	do	do	60	Light blue	.383	.4435	1, 1,839	140,810	No perceptible permanent bend. Medium fine granular.

SPECIMENS FROM OPEN HEARTH PLATE MARKED 6.

[Chemical composition: Carbon, .70; manganese, .460; silicon, .127. End supports 8" apart.]

No. of test.	Treatment.			Dimensions.			Ultimate strength.		Fracture.
	Color heated to—	Hardened in—		Temper drawn at—	Breadth.	Depth.	Total.	Maximum fiber stress.	
		Fluid.	Temper-ature.						
108	Bright red	Natural state.			Inch.	Inch.	Pounds.	Pounds.	Bent 30°. Medium fine granular, dull corner on tension side. Granular brittle. Hardening crack. Bent 35°. Medium fine granular, dull corner on tension side. Bent 50° without fracture.
146	do	Water	150	Full blue	.892	.4465	1,162	178,760	
104	do	Oil	60	do	.355	.445	1,320	225,320	
147	do	do	130	Light blue	.400	.4455	1,896	284,800	
					.289	.4428	1,268	289,890	

SPECIMENS FROM TWO BARS OF SPRING STEEL.

[Chemical composition: Carbon, .621; manganese, .582; silicon, .075. End supports 8" apart.]

187	Cherry red	Water	180	Not drawn	.439	.444	1,784	247,400	Fine granular. Bent 60°. Bent 75° without fracture. Bent 90° without fracture. Head on anvils and bent 90° when fracture occurred. Fine granular.
184	do	do	185	do	.438	.452	1,422	180,960	
177	Low cherry	Oil	70	Above light blue	.436	.453	1,746	234,230	
185	Cherry red	do	85	Light blue	.434	.441	1,468	211,280	
186	do	do	85	do	.392	.386	1,418	231,370	Do.
176	do	do		Blazed off twice in oil	.440	.442	2,176	311,700	Fine granular. Bent 48°.
182	do	do		do	.465	.448	2,210	304,540	Fine granular. Bent 49°.
183	do	do		Blazed off three times in oil. Fin s 11 y heated to straw.				303,700	Bent 67° without fracture.

TEMPERED STEEL STRIPS. BELLEVILLE SPRINGS EXPERIMENTAL METAL.  
 DETAILS OF TRANSVERSE TESTS.

Deflections for test specimens numbered—

Applied loads.	188	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154
Pounds	0. 0241	0. 0200	0. 0205	0. 0145	0. 0195	0. 0230	0. 0216	0. 0198	0. 0230	0. 0225	0. 0215	0. 0200	0. 0185	0. 0175	0. 0140	0. 0175	0. 0210
	0. 0431	0. 0350	0. 0355	0. 0290	0. 0347	0. 0347	0. 0278	0. 0245	0. 0472	0. 0412	0. 0415	0. 0345	0. 0270	0. 0205	0. 0230	0. 0220	0. 0253
	0. 0640	0. 0525	0. 0533	0. 0433	0. 0520	0. 0520	0. 0442	0. 0320	0. 0540	0. 0485	0. 0480	0. 0400	0. 0340	0. 0285	0. 0462	0. 0455	0. 0530
	0. 0854	0. 0690	0. 0705	0. 0570	0. 0685	0. 0715	0. 0542	0. 0400	0. 0695	0. 0625	0. 0600	0. 0512	0. 0440	0. 0385	0. 0628	0. 0622	0. 0700
	0. 1053	0. 0850	0. 0866	0. 0700	0. 0850	0. 0860	0. 0690	0. 0500	0. 0860	0. 0785	0. 0744	0. 0640	0. 0575	0. 0520	0. 0760	0. 0735	0. 0836
	0. 1240	0. 1025	0. 1040	0. 0833	0. 1108	0. 1090	0. 0860	0. 0650	0. 1098	0. 1025	0. 1025	0. 0920	0. 0825	0. 0772	0. 0945	0. 0945	0. 1020
	0. 1445	0. 1210	0. 1212	0. 0958	0. 1205	0. 1212	0. 0980	0. 0725	0. 1170	0. 1025	0. 1025	0. 0920	0. 0820	0. 0772	0. 1200	0. 1160	0. 1250
	0. 1670	0. 1366	0. 1366	0. 1100	0. 1340	0. 1375	0. 1025	0. 0800	0. 1340	0. 1191	0. 1191	0. 1090	0. 1035	0. 0980	0. 1368	0. 1300	0. 1385
	0. 1868	0. 2340	0. 2340	0. 1225	0. 1485	0. 1485	0. 1025	0. 0800	0. 1485	0. 1250	0. 1250	0. 1140	0. 1085	0. 1030	0. 1370	0. 1285	0. 1640
	0. 2140	0. 8660	0. 8660	0. 1370	0. 1635	0. 1635	0. 1100	0. 0800	0. 1635	0. 1450	0. 1450	0. 1318	0. 1275	0. 1220	0. 1395	0. 1320	0. 1698
	0. 2375	0. 1905	0. 1905	0. 1505	0. 1800	0. 1800	0. 1200	0. 0900	0. 1800	0. 1600	0. 1600	0. 1472	0. 1420	0. 1365	0. 1555	0. 1480	0. 1878
	0. 2685	0. 1630	0. 1630	0. 1630	0. 1980	0. 1980	0. 1300	0. 1000	0. 1980	0. 1780	0. 1780	0. 1645	0. 1590	0. 1535	0. 1760	0. 1710	0. 2050
	0. 1,400	0. 1,775	0. 1,775	0. 1,775	0. 1,980	0. 1,980	0. 1,400	0. 1,100	0. 1,980	0. 1,775	0. 1,775	0. 1,635	0. 1,580	0. 1,525	0. 1,750	0. 1,700	0. 2,250
	0. 1,425	0. 1,500	0. 1,500	0. 1,500	0. 1,600	0. 1,600	0. 1,425	0. 1,100	0. 1,600	0. 1,425	0. 1,425	0. 1,285	0. 1,230	0. 1,175	0. 1,400	0. 1,350	0. 1,800
	0. 1,500	0. 1,600	0. 1,600	0. 1,600	0. 1,700	0. 1,700	0. 1,500	0. 1,200	0. 1,700	0. 1,500	0. 1,500	0. 1,365	0. 1,310	0. 1,255	0. 1,480	0. 1,430	0. 1,900
	0. 1,600	0. 1,800	0. 1,800	0. 1,800	0. 1,900	0. 1,900	0. 1,600	0. 1,300	0. 1,900	0. 1,600	0. 1,600	0. 1,465	0. 1,410	0. 1,355	0. 1,580	0. 1,530	0. 2,000
	0. 1,964	0. 1,964	0. 1,964	0. 1,964	0. 2,000	0. 2,000	0. 1,964	0. 1,600	0. 2,000	0. 1,800	0. 1,800	0. 1,665	0. 1,610	0. 1,555	0. 1,780	0. 1,730	0. 2,300
	0. 2,000	0. 2,071	0. 2,071	0. 2,071	0. 2,100	0. 2,100	0. 2,000	0. 1,700	0. 2,100	0. 1,900	0. 1,900	0. 1,765	0. 1,710	0. 1,655	0. 1,880	0. 1,830	0. 2,400
	0. 2,100	0. 2,200	0. 2,200	0. 2,200	0. 2,286	0. 2,286	0. 2,100	0. 1,800	0. 2,286	0. 2,086	0. 2,086	0. 1,945	0. 1,890	0. 1,835	0. 2,060	0. 2,010	0. 2,600
	0. 2,286	0. 2,286	0. 2,286	0. 2,286	0. 2,286	0. 2,286	0. 2,286	0. 1,900	0. 2,286	0. 2,086	0. 2,086	0. 1,945	0. 1,890	0. 1,835	0. 2,060	0. 2,010	0. 2,600

DETAILS OF TRANSVERSE TESTS—Continued.

		Deflections for test specimens numbered—																	
Applied loads.		155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	
Pounds.		Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.
100	0.	.0260	.0160	.0170	.0161	.0210	.0200	.0178	.0280	.0195	.0226	.0235	.0165	.0144	.0224	.0240	.0270	.0224	
200	0.	.0425	.0290	.0312	.0320	.0355	.0380	.0276	.0460	.0345	.0405	.0438	.0308	.0265	.0355	.0438	.0499	.0352	
300	0.	.0661	.0425	.0445	.0440	.0505	.0495	.0428	.0664	.0498	.0638	.0648	.0453	.0376	.0600	.0750	.0712	.0526	
400	0.	.0850	.0572	.0572	.0594	.0653	.0625	.0531	.0865	.0640	.1375	.1470	.0630	.0510	.0865	.1190	.0930	.0670	
500	0.	.1250	.0798	.1860	.1250	.0798	.0798	.0531	.1123	.0788	.3900	.1470	.0780	.0654	.1560	.1140	.0831	.0631	
600	0.	.1720	.0945	.1860	.2100	.0945	.1720	.2780	.1270	.0960	.3900	.1470	.0780	.0654	.1560	.1140	.0831	.0631	
700	0.	.2090	.1090	.1860	.2100	.1090	.1090	.2780	.1535	.0960	.3900	.1470	.0780	.0654	.1560	.1140	.0831	.0631	
800	0.	.2690	.1210	.1860	.2100	.1210	.1210	.2780	.1535	.1112	.3900	.1470	.0780	.0654	.1560	.1140	.0831	.0631	
900	0.	.3300	.1300	.1860	.2100	.1300	.1300	.2780	.1535	.1310	.3900	.1470	.0780	.0654	.1560	.1140	.0831	.0631	
1,000	0.	.4000	.1300	.1860	.2100	.1300	.1300	.2780	.1535	.1426	.3900	.1470	.0780	.0654	.1560	.1140	.0831	.0631	
1,100	0.	.4700	.1300	.1860	.2100	.1300	.1300	.2780	.1535	.1618	.3900	.1470	.0780	.0654	.1560	.1140	.0831	.0631	
1,200	0.	.5400	.1300	.1860	.2100	.1300	.1300	.2780	.1535	.1766	.3900	.1470	.0780	.0654	.1560	.1140	.0831	.0631	
1,300	0.	.6100	.1300	.1860	.2100	.1300	.1300	.2780	.1535	.1965	.3900	.1470	.0780	.0654	.1560	.1140	.0831	.0631	
1,400	0.	.6800	.1300	.1860	.2100	.1300	.1300	.2780	.1535	.2143	.3900	.1470	.0780	.0654	.1560	.1140	.0831	.0631	
1,500	0.	.7500	.1300	.1860	.2100	.1300	.1300	.2780	.1535	.2370	.3900	.1470	.0780	.0654	.1560	.1140	.0831	.0631	
1,600	0.	.8200	.1300	.1860	.2100	.1300	.1300	.2780	.1535	.2604	.3900	.1470	.0780	.0654	.1560	.1140	.0831	.0631	
1,700	0.	.8900	.1300	.1860	.2100	.1300	.1300	.2780	.1535	.2860	.3900	.1470	.0780	.0654	.1560	.1140	.0831	.0631	
1,800	0.	.9600	.1300	.1860	.2100	.1300	.1300	.2780	.1535	.3230	.3900	.1470	.0780	.0654	.1560	.1140	.0831	.0631	
1,900	0.	1.0300	.1300	.1860	.2100	.1300	.1300	.2780	.1535	.3715	.3900	.1470	.0780	.0654	.1560	.1140	.0831	.0631	
2,000	0.	1.1000	.1300	.1860	.2100	.1300	.1300	.2780	.1535	.4480	.3900	.1470	.0780	.0654	.1560	.1140	.0831	.0631	



DETAILS OF TRANSVERSE TESTS. C. . . .

155 156

TENSILE TESTS OF HARDENED AND TEMPERED STEEL BARS.

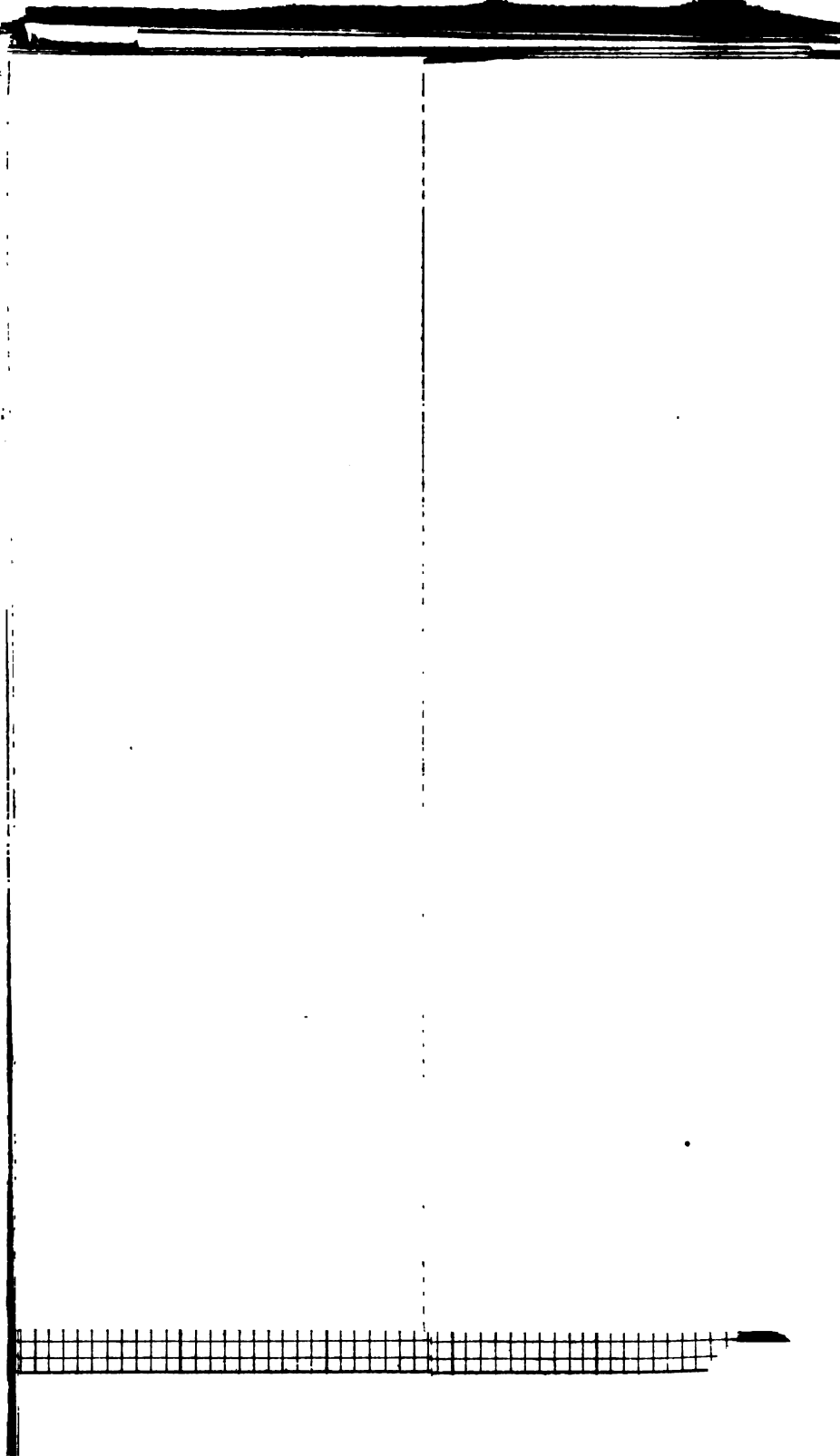
(Material from second series, temperature tests.)

The specimens were tested uniformly, within a piece of gas pipe which was directly exposed to the forge fire, to a temperature above those quenched in water or oil. The temper was drawn over gas burners and the specimen cooled in oil.



Sectional area, .25 square inch.

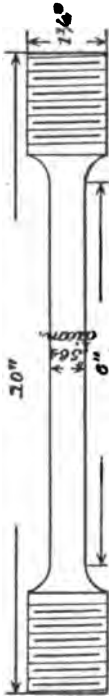
Specimen No.	Hardened In—	Temper drawn at—	Tensile strength.		Area at fracture.	Contraction of area.	Fracture.
			Total.	Per square inch.			
16	Water	Not drawn	Pounds.	Pounds.	.....	.....	.....
17	do	Purple and blue color	18,870	75,450	.....	Insupportable	1/2 from middle of stem. Fine granular.
18	do	do	20,480	101,920	.....	do	1/2 from neck. Fine granular.
19	do	Full blue (brilliant color)	37,070	150,860	19mm., 690	1 0	1/2 from neck. Fine granular.
20	do	do	36,640	146,160	19mm., 692	0 8	1/2 from middle of stem. Fine granular.
21	do	do	37,950	151,800	19mm., 692	Insupportable	1/2 from neck. Fine granular.
22	do	do	37,950	151,800	19mm., 440	39 3	At neck. Silky, interspersed with fine granulation.
23	do	do	38,800	155,200	.....	Insupportable	1/2 from middle of stem. Fine granular.
24	do	do	39,200	156,800	.....	do	1/2 from neck. Fine granular.
25	do	do	41,000	164,000	.....	do	1/2 from neck. Fine granular.
26	Oil	Not drawn	36,000	144,000	.....	do	1/2 from neck. Fine granular.
27	do	do	36,000	144,000	.....	do	1/2 from middle of stem. Fine granular.
28	do	do	36,000	144,000	.....	do	1/2 from neck. Fine granular.
29	do	do	36,000	144,000	.....	do	1/2 from middle of stem. Fine granular.
30	do	do	36,000	144,000	.....	do	1/2 from neck. Fine granular.
31	do	do	36,000	144,000	.....	do	1/2 from middle of stem. Fine granular.
32	do	do	36,000	144,000	.....	do	1/2 from neck. Fine granular.
33	do	do	36,000	144,000	.....	do	1/2 from middle of stem. Fine granular.
34	do	do	36,000	144,000	.....	do	1/2 from neck. Fine granular.
35	do	do	36,000	144,000	.....	do	1/2 from middle of stem. Fine granular.
36	do	do	36,000	144,000	.....	do	1/2 from neck. Fine granular.
37	do	do	36,000	144,000	.....	do	1/2 from middle of stem. Fine granular.
38	do	do	36,000	144,000	.....	do	1/2 from neck. Fine granular.
39	do	do	36,000	144,000	.....	do	1/2 from middle of stem. Fine granular.
40	do	do	36,000	144,000	.....	do	1/2 from neck. Fine granular.
41	do	do	36,000	144,000	.....	do	1/2 from middle of stem. Fine granular.
42	do	do	36,000	144,000	.....	do	1/2 from neck. Fine granular.
43	do	do	36,000	144,000	.....	do	1/2 from middle of stem. Fine granular.
44	do	do	36,000	144,000	.....	do	1/2 from neck. Fine granular.
45	do	do	36,000	144,000	.....	do	1/2 from middle of stem. Fine granular.
46	do	do	36,000	144,000	.....	do	1/2 from neck. Fine granular.
47	do	do	36,000	144,000	.....	do	1/2 from middle of stem. Fine granular.
48	do	do	36,000	144,000	.....	do	1/2 from neck. Fine granular.
49	do	do	36,000	144,000	.....	do	1/2 from middle of stem. Fine granular.
50	do	do	36,000	144,000	.....	do	1/2 from neck. Fine granular.
51	do	do	36,000	144,000	.....	do	1/2 from middle of stem. Fine granular.
52	do	do	36,000	144,000	.....	do	1/2 from neck. Fine granular.
53	do	do	36,000	144,000	.....	do	1/2 from middle of stem. Fine granular.
54	do	do	36,000	144,000	.....	do	1/2 from neck. Fine granular.
55	do	do	36,000	144,000	.....	do	1/2 from middle of stem. Fine granular.
56	do	do	36,000	144,000	.....	do	1/2 from neck. Fine granular.
57	do	do	36,000	144,000	.....	do	1/2 from middle of stem. Fine granular.
58	do	do	36,000	144,000	.....	do	1/2 from neck. Fine granular.
59	do	do	36,000	144,000	.....	do	1/2 from middle of stem. Fine granular.
60	do	do	36,000	144,000	.....	do	1/2 from neck. Fine granular.
61	do	do	36,000	144,000	.....	do	1/2 from middle of stem. Fine granular.
62	do	do	36,000	144,000	.....	do	1/2 from neck. Fine granular.
63	do	do	36,000	144,000	.....	do	1/2 from middle of stem. Fine granular.
64	do	do	36,000	144,000	.....	do	1/2 from neck. Fine granular.
65	do	do	36,000	144,000	.....	do	1/2 from middle of stem. Fine granular.
66	do	do	36,000	144,000	.....	do	1/2 from neck. Fine granular.
67	do	do	36,000	144,000	.....	do	1/2 from middle of stem. Fine granular.
68	do	do	36,000	144,000	.....	do	1/2 from neck. Fine granular.
69	do	do	36,000	144,000	.....	do	1/2 from middle of stem. Fine granular.
70	do	do	36,000	144,000	.....	do	1/2 from neck. Fine granular.
71	do	do	36,000	144,000	.....	do	1/2 from middle of stem. Fine granular.
72	do	do	36,000	144,000	.....	do	1/2 from neck. Fine granular.
73	do	do	36,000	144,000	.....	do	1/2 from middle of stem. Fine granular.
74	do	do	36,000	144,000	.....	do	1/2 from neck. Fine granular.
75	do	do	36,000	144,000	.....	do	1/2 from middle of stem. Fine granular.
76	do	do	36,000	144,000	.....	do	1/2 from neck. Fine granular.
77	do	do	36,000	144,000	.....	do	1/2 from middle of stem. Fine granular.
78	do	do	36,000	144,000	.....	do	1/2 from neck. Fine granular.
79	do	do	36,000	144,000	.....	do	1/2 from middle of stem. Fine granular.
80	do	do	36,000	144,000	.....	do	1/2 from neck. Fine granular.



TENSILE TESTS OF HARDENED AND TEMPERED STEEL BARS.

[Material from second series, temperature tests.]

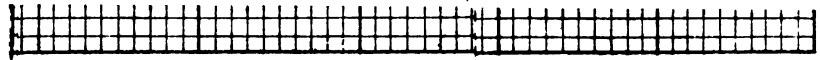
The specimens were heated uniformly, within a piece of gas pipe which was directly exposed to the forge fire, to a bright red, and then quenched in water or oil. The temper was drawn over gas-burners and the specimen cooled in oil.



Sectional area, .25 square inch.

No. of test.	Marks.	Hardened in—	Temper drawn at—	Tensile strength.		Area at fracture.	Contraction of area.	Fracture.
				Pounds.	Persquare inch.			
5555	10	Water	Not drawn	18,870	75,450	.....	Insappreciable	" 7 from middle of stem. Fine granular.
5556	10	do	Purple and blue color	23,690	101,990	.....	.....	" 7 from neck. Fine granular.
5557	10	do	Full blue. (Brilliant color)	27,870	109,660	Diam., .560—.248	.....	" 5 from neck. Fine granular.
5558	10	do	do	26,540	106,160	Diam., .562—.248	.....	" 5 from middle of stem. Fine granular.
5559	10	do	do	27,850	111,800	.....	.....	" 5 from neck. Fine granular.
5590	10	Oil	Not drawn	27,850	111,800	Diam., .440—.152	.....	At neck. Silky interspersed with fine granulation.
5591	15	Water	do	10,810	43,240	.....	.....	" 3 from middle of stem. Fine granular.
5592	15	do	Full blue	26,950	117,840	.....	.....	" 3 from neck. Fine granular.
5593	15	do	Light blue	31,750	127,000	.....	.....	" 3 from neck. Fine granular.
5594	15	do	Above light blue	28,100	112,400	.....	.....	" 3 from neck. Fine granular.
5595	15	do	Not drawn	33,520	134,080	.....	.....	" 4 from middle of stem. Fine granular.
5596	15	Oil	Not drawn	33,520	134,080	.....	.....	" 4 from middle of stem. Fine granular.





**SPECIMENS FROM BESSEMER PLATE MARKED 8.**

[Chemical composition: Carbon, .47; manganese, .620; silicon, .363. End supports 8" apart.]

No. of test.	Color heated to—		Treatment.		Dimensions.			Ultimate strength.		Fracture.
	Natural state	Fluid.	Hardened in—		Breadth.	Depth.	Total.	Maximum fiber stress.		
			Temper-ature.	Temper drawn at—						
133	Natural state	.....	.....	.....	Inch. .290	Inch. .446	Pounds. 638	Pounds. 133,150	Rapid yielding at 450 pounds. Bent 70° then fractured. Silky 40 per cent on tension side, granular 60 per cent on compression side.	
161	Full cherry	Water	Not drawn	.....	.424	.4325	1,070	147,760	Bent 65° without fracture.	
164	Bright red	do	do	.....	.380	.453	1,248	192,930	Bent 25°. Silky.	
165	Full cherry	do	Not drawn, hammered cold	.....	.418	.447	1,404	214,610	Do.	
158	Low cherry	do	Light blue	.....	.416	.4472	984	118,080	Bent 62° without fracture.	
133	Bright red	do	Full blue	.....	.335	.4428	1,206	237,430	Bent 18° then fractured. Fine granular.	
134	do	do	do	.....	.336	.442	1,049	192,180	Bent 72° without fracture.	
125	do	do	do	.....	.325	.4185	1,306	239,630	Bent 45° then fractured.	
101	do	do	Light blue	.....	.3656	.4487	1,554	259,180	Bent 19° Silky 25 per cent, granular 75 per cent.	
102	do	do	do	.....	.404	.4504	1,753	257,376	Brittle. Fine granular.	
133	do	do	Above light blue	.....	.4075	.4504	2,043	299,700	Bent 32° Silky.	
188	do	Oil	Light blue	.....	.374	.4443	1,538	251,100	Bent 41°. Silky 15 per cent, fine granular 85 per cent.	
180	do	do	Above light blue	.....	.407	.4426	1,590	224,400	Bent 41°. Silky 30 per cent, granular 20 per cent.	
159	Very bright red.	do	Light blue	.....	.421	.444	1,758	254,320	Bent 25°. Silky 5 per cent, granular 95 per cent.	

**SPECIMENS FROM BESSEMER PLATE MARKED 5.**

[Chemical composition: Carbon, .43; manganese, 1.25; silicon, .068. End supports 8" apart.]

149	Natural state.	.....	.....	.....	.332	.406	724	159,410	Bent 70° without fracture.
105	Bright red	Water	Not drawn	.....	.440	.414	445	71,200	No perceptible permanent bend. Fine granular. Seam at middle of thickness .30 deep.
160	Full blood red	do	Light blue	.....	.351	.412	750	151,260	Bent 60° without fracture.
155	Low cherry red.	do	do	.....	.380	.411	560	103,380	Fine granular. Hardening crack.
162	do	do	Above light blue	.....	.346	.406	1,487	313,050	Fine granular; brittle.

106	Bright red	.....do	.428	.411	768	127, 120	No perceptible permanent bend. Fine granular. Seam at middle of thickness. Hardening crack $\frac{1}{16}$ deep from compression surface.
107	do	.....do	.468	.417	995	146, 600	No perceptible permanent bend. Medium fine granular. Seam at middle of thickness $\frac{1}{32}$ deep.
108	do	.....do	.446	.411	1,305	207, 420	No perceptible permanent bend. Fine granular. Seam at middle of thickness $\frac{1}{32}$ deep.
109	Blood red	Oil	.359	.410	805	160, 070	Bent 64° without fracture
110	Bright red	.....do	.501	.4125	1,088	238, 720	No perceptible permanent bend. Fine granular. Triangular piece detached from compression side of bend.
111	do	.....do	.383	.410	806	150, 190	Bent 72° without fracture.
112	do	.....do	.450	2,052	320, 630	329, 300	Fine granular. Hardening crack.
	do	.....do	.427	.407	1,982	337, 360	Fine granular, brittle.
	do	.....do	.319	1,238	290, 300	328, 750	Bent about 2°. Fine granular. Triangular piece detached from compression side of bend.
	do	.....do	.441	2,041			Bent about 5°. Medium fine granular. Triangular piece detached from compression side of bend.
	do	.....do	.473	.410	1,019	243, 920	Do.
	do	.....do	.511	.4124	2,200	303, 450	

SPECIMENS FROM BESSEMER PLATE MARKED 9.



[Chemical composition: Carbon, .48; manganese, 1.25; silicon, .068. End supports 8" apart.]

119	Bright red	Oil	.367	.410	1,532	298, 930	} No perceptible permanent bend. Fine granular. Triangular piece detached from compression side of bend.
120	do	.....do	.440	.409	1,924	314, 120	
121	do	.....do	.358	.405	1,446	296, 620	

The fourth strip taken from this plate was quenched in oil and split through the middle of the thickness of the plate a distance of 7". This crack occurred after quenching, and developed during the night. The strip was intact one and one-half hours after quenching and was found cracked in the morning, fourteen hours later.

SPECIMENS FROM BESEMER PLATE MARKED 2.

[Chemical composition: Carbon, .59; manganese, 1.04; silicon, .28. End supports 8' apart.]

No. of test.	Treatment.		Dimensions.			Ultimate strength.		Fracture.
	Color heated to—	Hardened in—	Temper drawn at—	Breadth.	Depth.	Total.	Maximum fiber stress.	
		Fluid.						
149	Natural state.			Inch.	Inch.	Pounds.	Pounds.	 <p>Bent 75° without fracture. Bent 45° without fracture. Fine granular</p>
148	Low cherry	Water	105	.350 .453	.453	1,048 1,994	175,260 183,870	
151	Cherry red	do	157	.317 .395	.454	1,994	289,180	
153	do	do	152	.369	.454	2,071	327,000	
166	High red	Oil	60	.395 .403	.453	1,188	168,500	
167	Low cherry	do	60	.440 .453	.449	1,292	167,340	 <p>Bent 50° without fracture. Bent 53° without fracture. Fine granular</p>
150	Cherry red	do	64	.423	.453	2,298	324,420	
152	do	do	66	.352	.453	1,428	238,000	

SPECIMENS FROM OPEN HEARTH PLATE MARKED 3.

[Chemical composition: Carbon, .60; manganese, .423; silicon, .105. End supports 8' apart.]

113	Bright red	Natural state.	147	.475	.4518	1,284	184,850	<p>Bent 60° without fracture. Granular, brittle. Hardening orsak. Do.</p> <p>Bent 51° without fracture. Bent 54° without fracture. Bent 48° without fracture. Bent 81° without fracture. Bent 60° without fracture. Bent 50° without fracture. Bent 75° without fracture.</p>
138	do	Water	152	.387	.451	1,920	291,440	
141	do	Salt water.		.366	.449	1,500	225,500	
140	do	Oil	42	.304	.453	1,105	212,840	
114	do	do	60	.402	.4494	1,552	238,980	
115	do	do	60	.485	.450	1,950	288,780	
116	do	do	60	.489	.458	2,056	246,720	
117	do	do	60	.488	.448	1,965	243,000	
139	do	do	47	.356	.446	1,290	231,500	
118	do	do	60	.380	.445	1,522	243,520	

SPECIMENS FROM OPEN HEARTH PLATE MARKED 7.

[Chemical composition: Carbon, .60; manganese, .422; silicon, .105. End supports 8" apart.]

157	Cherry red	Water	177	Not drawn	.455	1,020	140,660	Bent 70° without fracture.
156	do	do	170	Light blue	.452	1,148	164,960	Bent 70° without fracture.
160	do	do	176	do	.443	946	164,520	Bent 75° without fracture.
125	Bright red	do	200	Not drawn	.4503	990	202,760	Rapid yielding began at 600 pounds. Bent 60° without fracture.
122	do	do	50	Full blue	.449	1,118	197,260	No appreciable permanent bend. Medium fine granular.
124	do	do	200	do	.448	1,210	211,970	Hardening crack $\frac{1}{2}$ wide along middle of thickness.
128	do	do	50	Light blue	.448	1,366	250,260	Rapid yielding began at 680 pounds. Bent 55° without fracture.
174	do	do	170	Above light blue	.4470	2,036	300,520	No appreciable permanent bend. Medium fine granular.
181	do	do	180	do	.4625	1,982	303,370	Hardening crack $\frac{1}{2}$ wide along middle of thickness.
179	do	do	181	do	.452	1,726	283,730	No appreciable permanent bend. Medium fine granular.
180	do	Salt water	182	do	.451	1,489	294,180	Hardening crack $\frac{1}{2}$ wide along middle of thickness.
175	do	do	180	do	.449	1,914	334,060	Fine granular.
173	do	Oil	60	Light blue	.450	1,621	250,960	Fine granular. Bent 32°.
178	do	do	66	do	.450	1,638	252,810	Fine granular. Bent 30°.

SPECIMENS FROM OPEN HEARTH PLATE MARKED 0.

[Chemical composition: Carbon, .70; manganese, .460; silicon, .137. End supports, 8" apart.]

171	Full cherry	Water	192	Light blue	.443	1,496	254,640	Coarse, granular, brittle. Hardening crack.
95	Bright red	do	60	Dark straw	.445	568	72,000	Medium fine granular. Bent 2°.
96	do	do	60	Purple to blue	.454	912	125,070	No perceptible permanent bend. Fine granular.
97	do	do	60	Full blue	.4455	689	100,230	No perceptible permanent bend. Fine granular. Hardening crack at corner on compression side.
98	do	do	40	Light blue	.445	1,215	184,400	No perceptible permanent bend. Medium fine granular. Seam at middle of thickness of plate.
159	Full cherry	Oil	90	do	.442	2,090	327,420	Fine granular.
172	do	do	55	Above light blue	.444	1,990	341,870	Fine granular. Bent about 6°.
99	Bright red	do	60	Light straw	.447	1,252	175,720	Fine granular. No perceptible permanent bend.
100	do	do	66	Dark purple	.4425	1,478	236,480	Do.
101	do	do	60	Purple to blue	.445	1,688	256,300	Bent 30° without fracture.
102	do	do	60	Light blue	.4435	1,839	140,810	No perceptible permanent bend. Medium fine granular.

## SPECIMENS FROM OPEN HEARTH PLATE MARKED 6.

[Chemical composition: Carbon, .70; manganese, .460; silicon, .127. End supports 8' apart.]

No. of test.	Treatment.		Dimensions.		Ultimate strength.		Fracture.	
	Color heated to—	Hardened in— Fluid.	Temper drawn at— of.	Breadth.	Depth.	Total.		Maximum fiber stress.
103	Bright red	Natural state.	Full blue	.892	.445	1,162	178,760	
146	do	Water	do	.355	.445	1,320	225,320	
104	do	Oil	do	.400	.445	1,898	288,000	
147	do	do	Light blue	.299	.442	1,268	280,830	

Bent 36°. Medium fine granular, dull corner on tension side.  
 Granular, brittle. Hardening crack.  
 Bent 53°. Medium fine granular, dull corner on tension side.  
 Bent 59° without fracture.

## SPECIMENS FROM TWO BARS OF SPRING STEEL.

[Chemical composition: Carbon, .621; manganese, .582; silicon, .076. End supports 8' apart.]

187	Cherry red	Water	Not drawn	.439	.444	1,784	247,400	Fine granular. Bent 60°.
184	do	do	do	.438	.652	1,492	190,980	Bent 75° without fracture.
177	Low cherry	Oil	Above light blue	.436	.453	1,746	234,230	Bent 62° without fracture. Held on anvil and bent 99° when fracture occurred. Fine granular.
185	Cherry red	do	Light blue	.434	.441	1,486	211,280	Fine granular, brittle.
196	do	do	do	.392	.386	1,418	221,770	Fine granular. Bent 49°.
176	do	do	Blazed off twice in oil	.440	.442	2,176	311,700	Fine granular. Bent 49°.
182	do	do	Blazed off three times	.465	.446	2,210	304,340	Fine granular. Bent 49°.
183	do	do	In oil. Fin ally heated to straw.				303,790	Bent 67° without fracture.

TEMPERED STEEL STRIPS. BELLEVILLE SPRINGS EXPERIMENTAL METAL.

DETAILS OF TRANSVERSE TESTS.

Deflections for test specimens numbered—

Applied loads.	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154
Pounds.																	
100	.0241	.0200	.0206	.0145	.0196	.0230	.0216	.0198	.0220	.0225	.0815	.0200	.0165	.0175	.0140	.0175	.0210
200	.0435	.0350	.0355	.0290	.0347	.0347	.0378	.0345	.0402	.0412	.0645	.0345	.0270	.0295	.0320	.0320	.0358
300	.0640	.0525	.0533	.0433	.0520	.0535	.0542	.0520	.0540	.0635	.1290	.0500	.0420	.0435	.0462	.0453	.0530
400	.0854	.0690	.0705	.0570	.0633	.0745	.0756	.0690	.0805	.0825	.2900	.0713	.0541	.0568	.0628	.0598	.0700
500	.1033	.0850	.0866	.0700	.0850	.0840	.1021	.0880	.0960	.1051	.....	.1144	.0675	.0705	.0760	.0735	.0656
600	.1260	.1025	.1008	.0853	.1108	.1038	.1890	.1070	.1008	.1330	.....	.2520	.0675	.0792	.0845	.0873	.1090
700	.1465	.1210	.1211	.0958	.1705	.1312	.....	.1725	.1170	.1625	.....	.0630	.0630	.1010	.1200	.0990	.1183
800	.1670	.1565	.....	.1100	.2840	.1975	.....	.....	.1240	.1991	.....	.1055	.1055	.1142	.1585	.1160	.1385
900	.1868	.2340	.....	.1225	.....	.....	.....	.....	.1485	.2950	.....	.1190	.1190	.1308	.1970	.1286	.1540
1,000	.2140	.3660	.....	.1370	.....	.....	.....	.....	.1635	.4250	.....	.1318	.1475	.2395	.....	.1420	.1698
1,100	.2375	.....	.....	.1505	.....	.....	.....	.....	.1800	.....	.....	.1472	.1702	.....	.....	.1556	.1875
1,200	.2685	.....	.....	.1630	.....	.....	.....	.....	.1990	.....	.....	.1645	.1950	.....	.....	.1710	.2050
1,300	.....	.....	.....	.1775	.....	.....	.....	.....	.....	.....	.....	.1835	.2225	.....	.....	.1835	.2230
1,400	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.2048	.....	.....	.2000	.2455
1,425	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.2220	.....	.....	.2000	.....
1,500	.....	.....	.....	.1900	.....	.....	.....	.....	.....	.....	.....	.....	.2220	.....	.....	.2198	.....
1,600	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.2430	.....	.....	.2360	.....
1,700	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.2725	.....	.....	.2370	.....
1,800	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.3038	.....	.....	.2815	.....
1,900	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.2815	.....
1,964	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.4360	.....
2,000	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
2,071	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.3120	.....
2,100	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.3800	.....
2,200	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.4280	.....
2,268	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.5000	.....



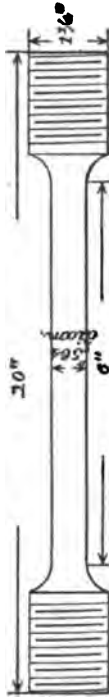




TENSILE TESTS OF HARDENED AND TEMPERED STEEL BARS.

[Material from second series, temperature tests.]

The specimens were heated uniformly, within a piece of gas pipe which was directly exposed to the forge fire, to a bright red, and then quenched in water or oil. The temper was drawn over gas-burners and the specimen cooled in oil.



Sectional area, .25 square inch.

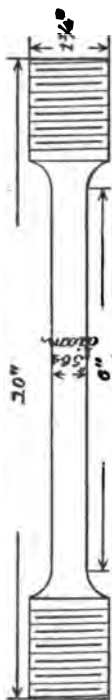
No. of test.	Marks.	Hardened in—	Temper drawn at—	Tensile strength.		Area at fracture.	Contraction of area.	Fracture.
				Total.	Per square inch.			
5555	10	Water	Not drawn	Pounds, 18,870	Pounds, 75,480	.....	Inappreciable	1/7 from middle of stem. Fine granular.
5556	10	do	Purple and blue color	25,480	101,920	.....	do	1/5 from neck. Fine granular.
5557	10	do	Full blue. (Brilliant color)	37,670	150,680	.....	do	1/5 from neck. Fine granular.
5558	10	do	do	36,540	146,160	Diam., .560 = .248	1.6	1/4 from middle of stem. Fine granular.
5559	10	do	do	17,950	71,800	Diam., .562 = .248	0.8	1/4 from neck. Fine granular.
5560	10	Oil	do	17,950	71,800	.....	Inappreciable	At neck. Silky, interspersed with fine granulation.
5561	15	Water	Not drawn	10,810	43,240	Diam., .440 = .152	39.2	1/4 from middle of stem. Fine granular.
5562	15	do	do	26,960	117,840	.....	do	1/4 from neck. Fine granular.
5563	15	do	Full blue	31,750	127,000	.....	do	1/4 from neck. Fine granular.
5564	15	do	Light blue	28,100	112,400	.....	do	1/4 from neck. Fine granular.
5565	15	Oil	Above light blue	33,520	134,080	.....	do	1/4 from middle of stem. Fine granular.
5566	15	do	Not drawn	33,520	134,080	.....	do	1/4 from middle of stem. Fine granular.



## TENSILE TESTS OF HARDENED AND TEMPERED STEEL BARS.

[Material from second series, temperature tests.]

The specimens were heated uniformly, within a piece of gas pipe which was directly exposed to the forge fire, to a bright red, and then quenched in water or oil. The temper was drawn over gas-burners and the specimen cooled in oil.

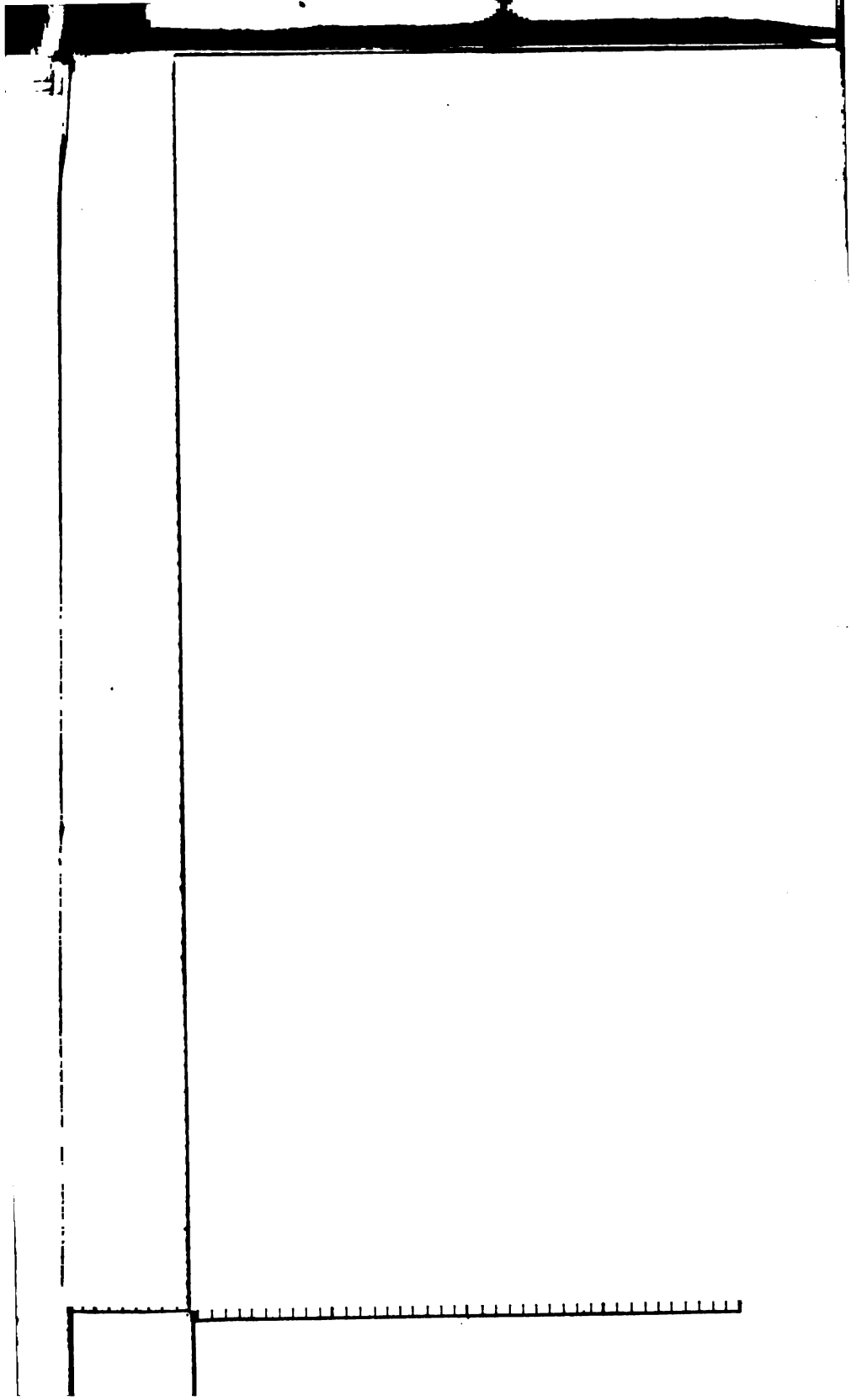


Sectional area, .25 square inch.

No. of test.	Marks.	Hardened in—	Temper drawn at—	Tensile strength.		Area at fracture.	Contraction of area.	Fracture.
				Total.	Per square inch.			
5555	10	Water	Not drawn.	Pounds.	Per cent.			1/7 from middle of stem. Fine granular.
5556	10	do	Purple and blue color.	18,870	Inappreciable			1/5 from neck. Fine granular.
5557	10	do	Full blue. (Brilliant color)	25,480	do	□ 1/4	1.6	1/5 from neck. Fine granular.
5558	10	do	do	37,670	Diam., .560 = .248		0.8	1/5 from middle of stem. Fine granular.
5559	10	do	do	36,540	Diam., .562 = .248			1/5 from neck. Fine granular.
5560	10	Oil	Not drawn	17,950	Inappreciable			At neck. Silky, interspersed with fine granulation.
5561	15	Water	do	27,950	39.2			1/5 from middle of stem. Fine granular.
5562	15	do	Full blue	10,810	do			1/5 from neck. Fine granular.
5563	15	do	Light blue	26,960	do			1/5 from neck. Fine granular.
5564	15	do	Above light blue	31,750	do			1/5 from neck. Fine granular.
5565	15	Oil	Not drawn.	26,100	do			1/4 from middle of stem. Fine granular.
				33,520	do			

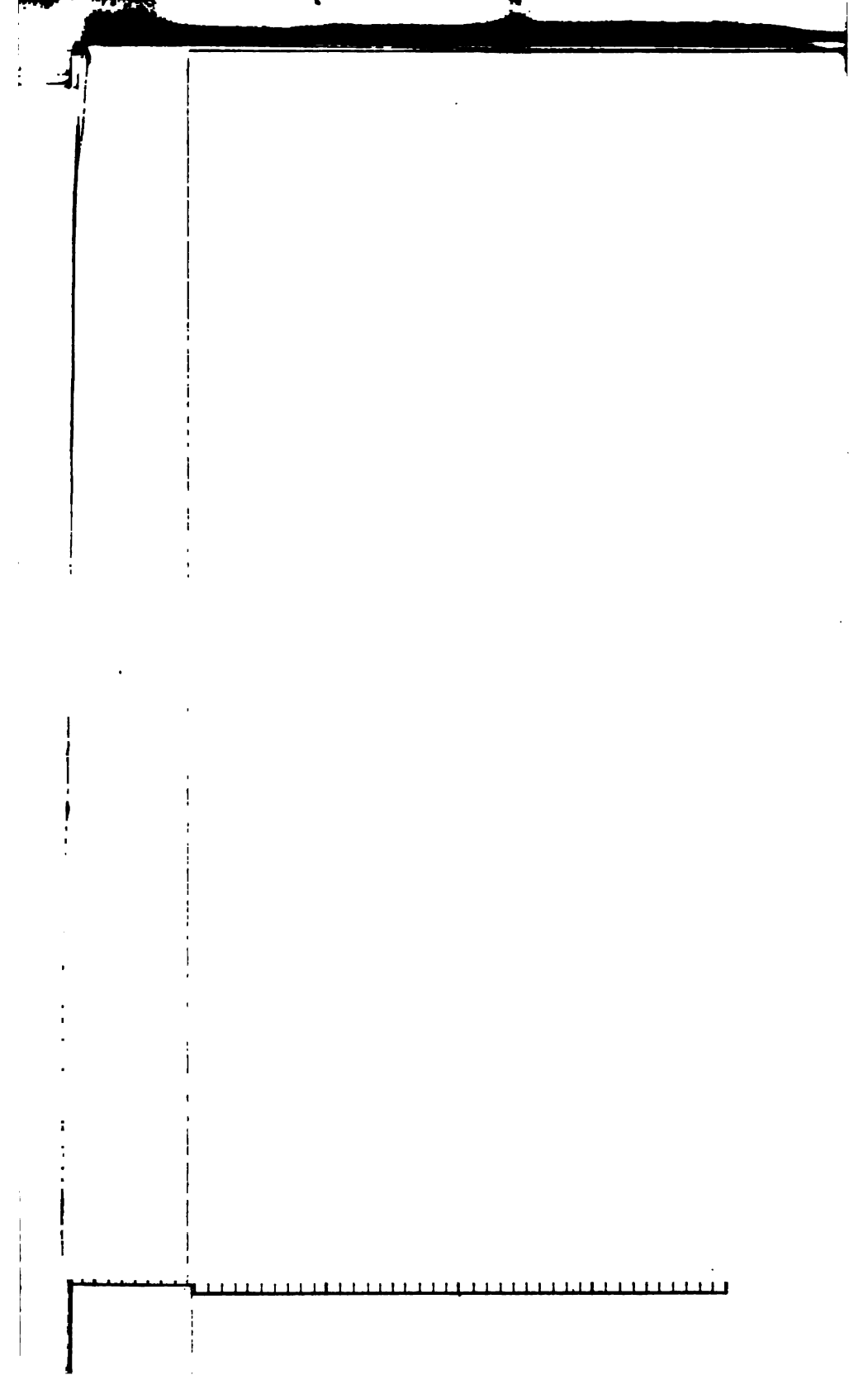


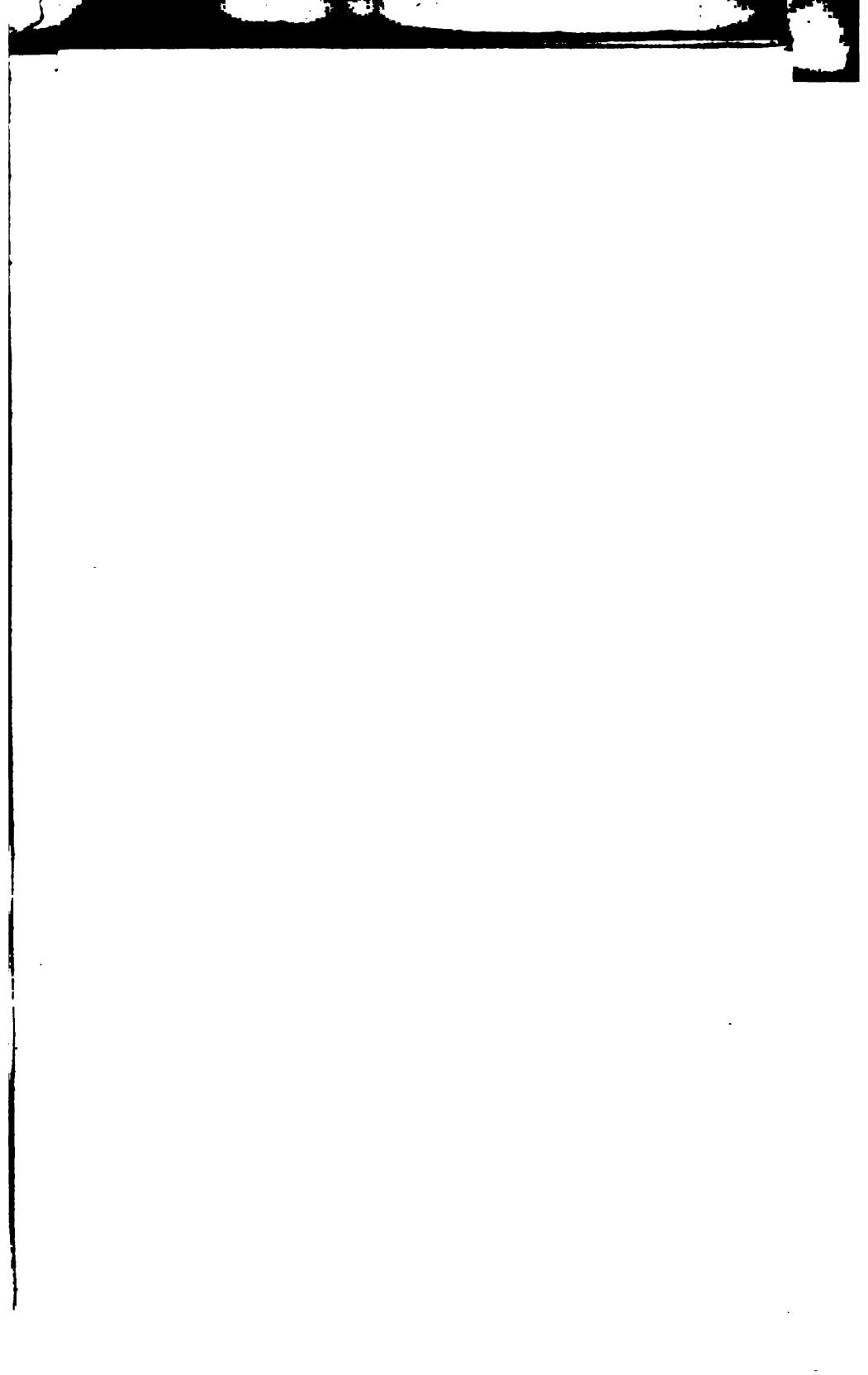


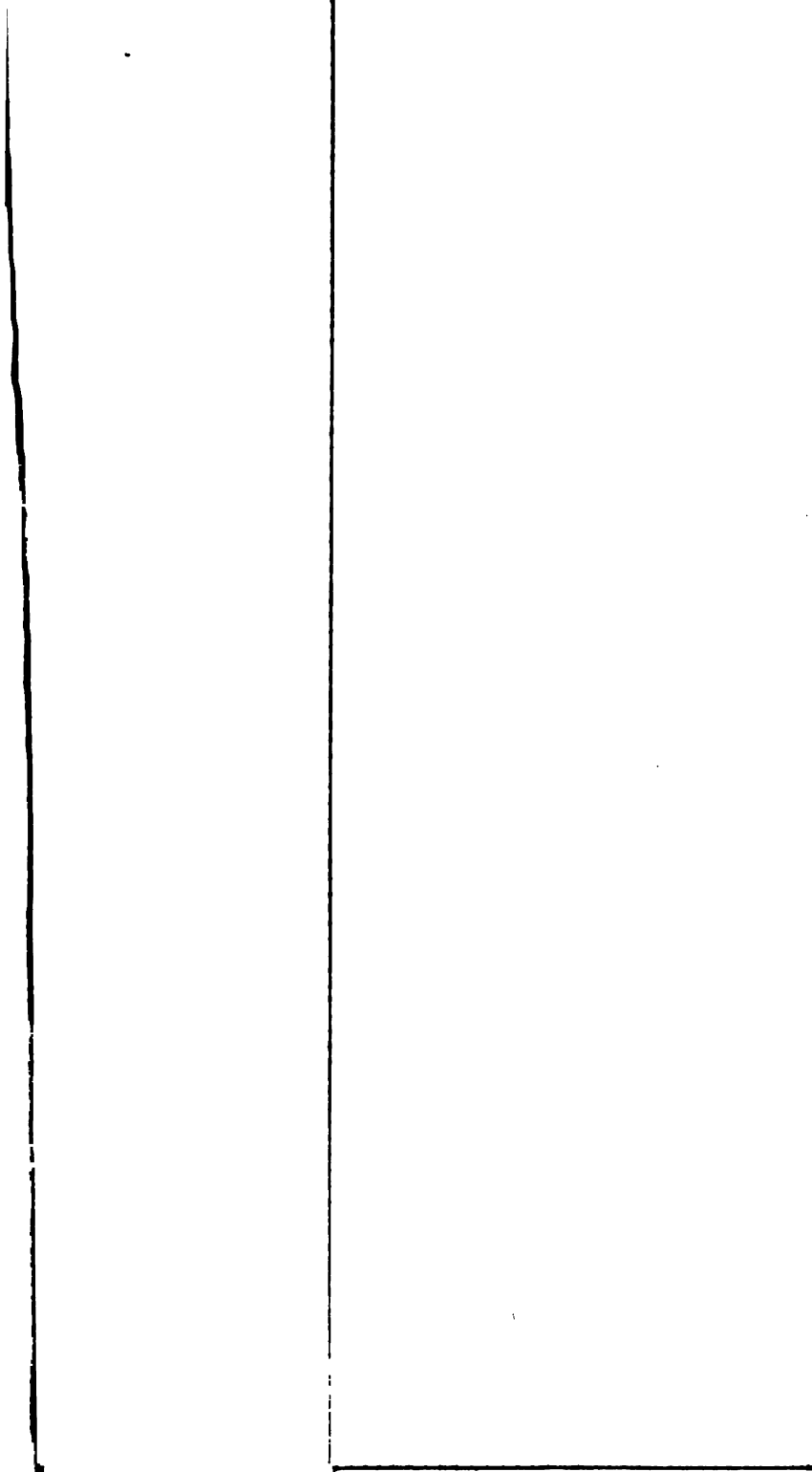


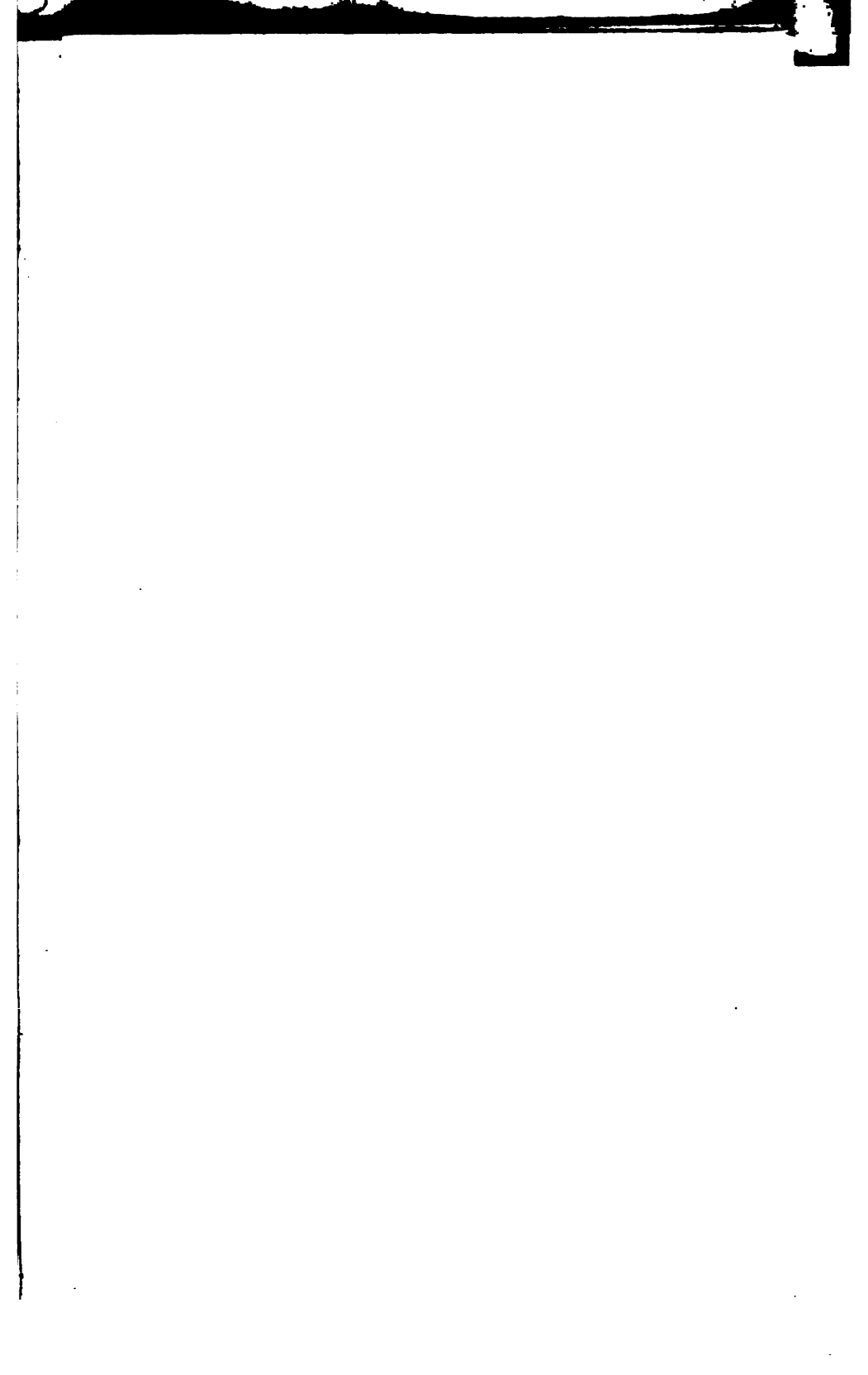
AND TEMPERED STEEL.





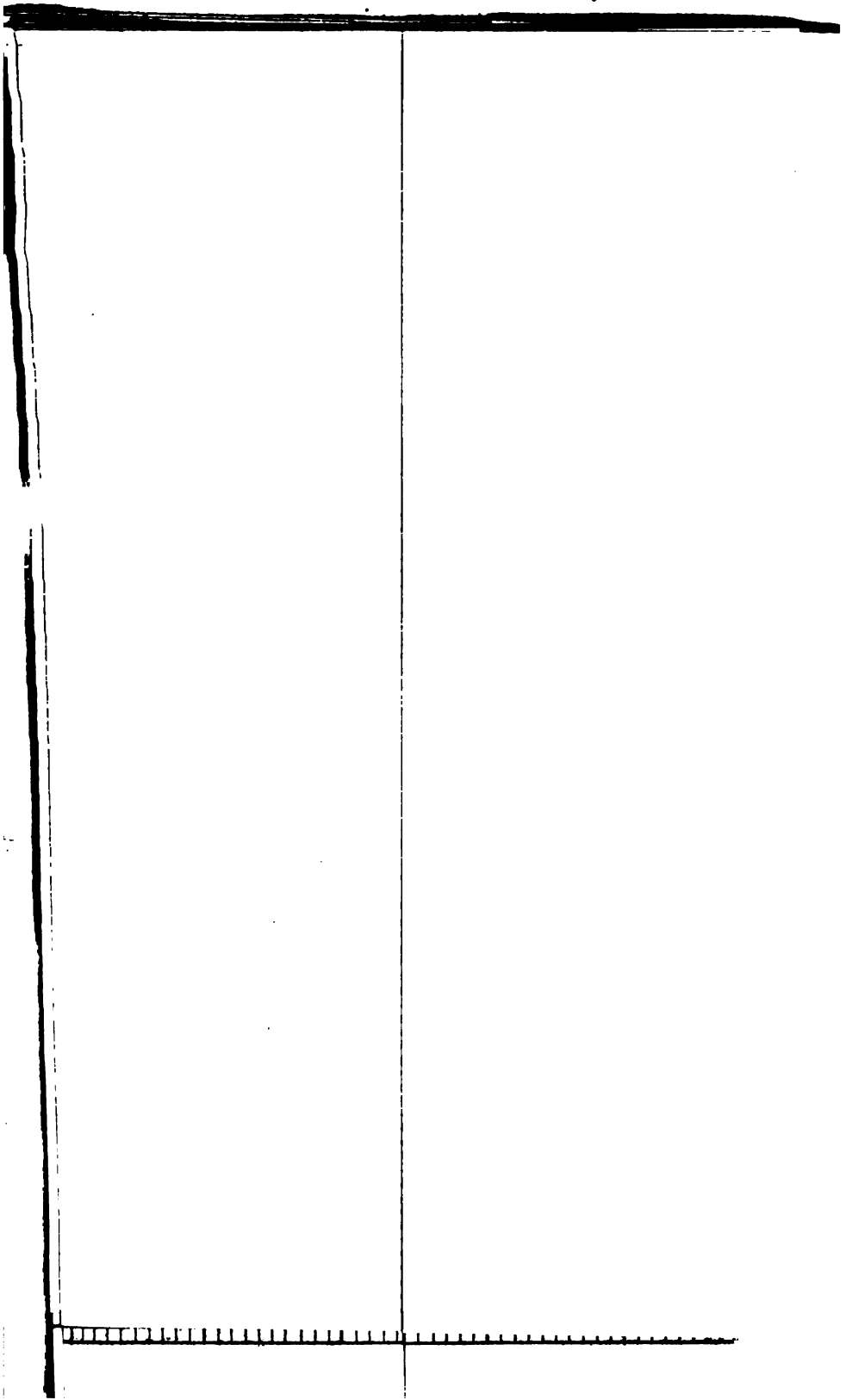


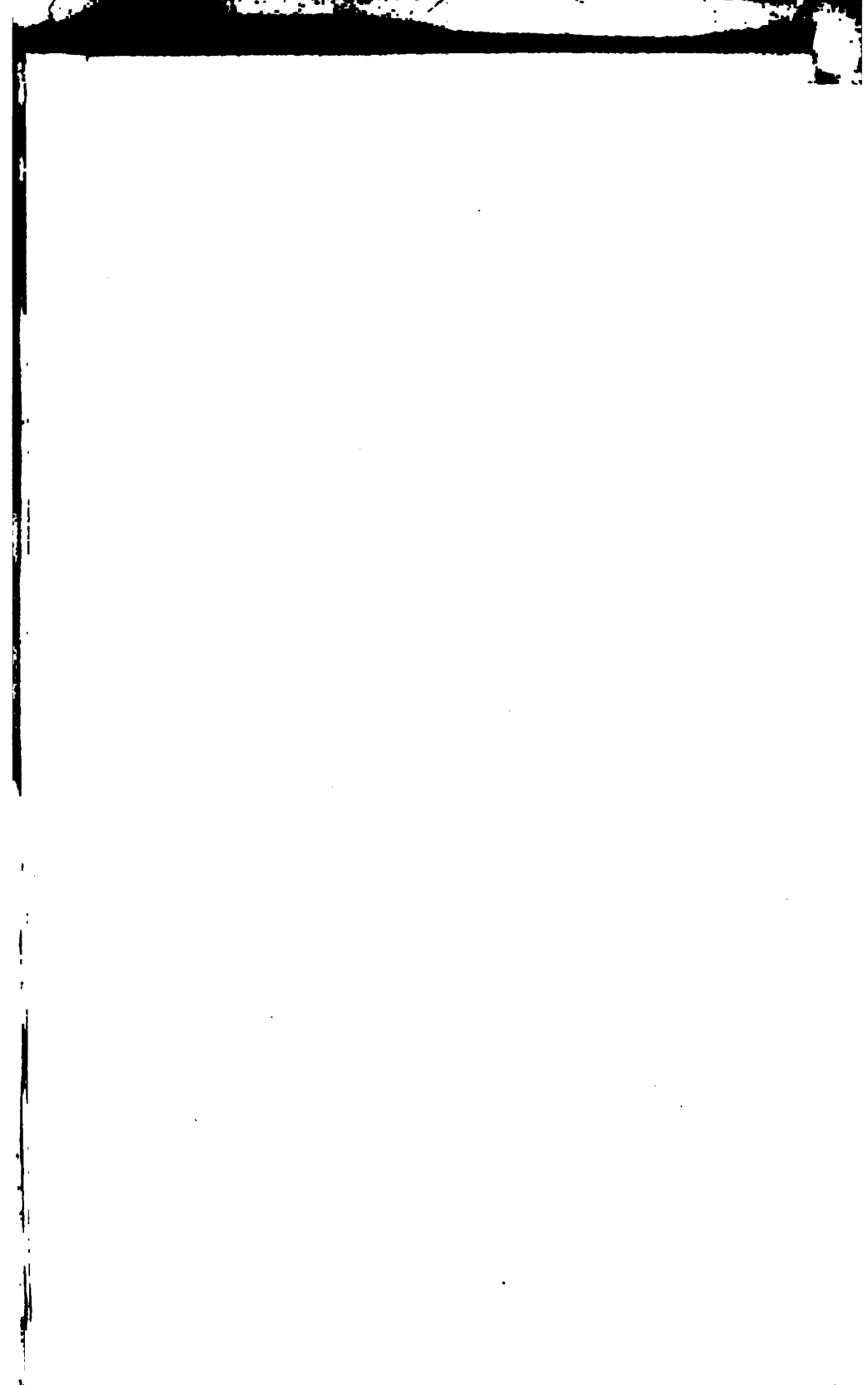




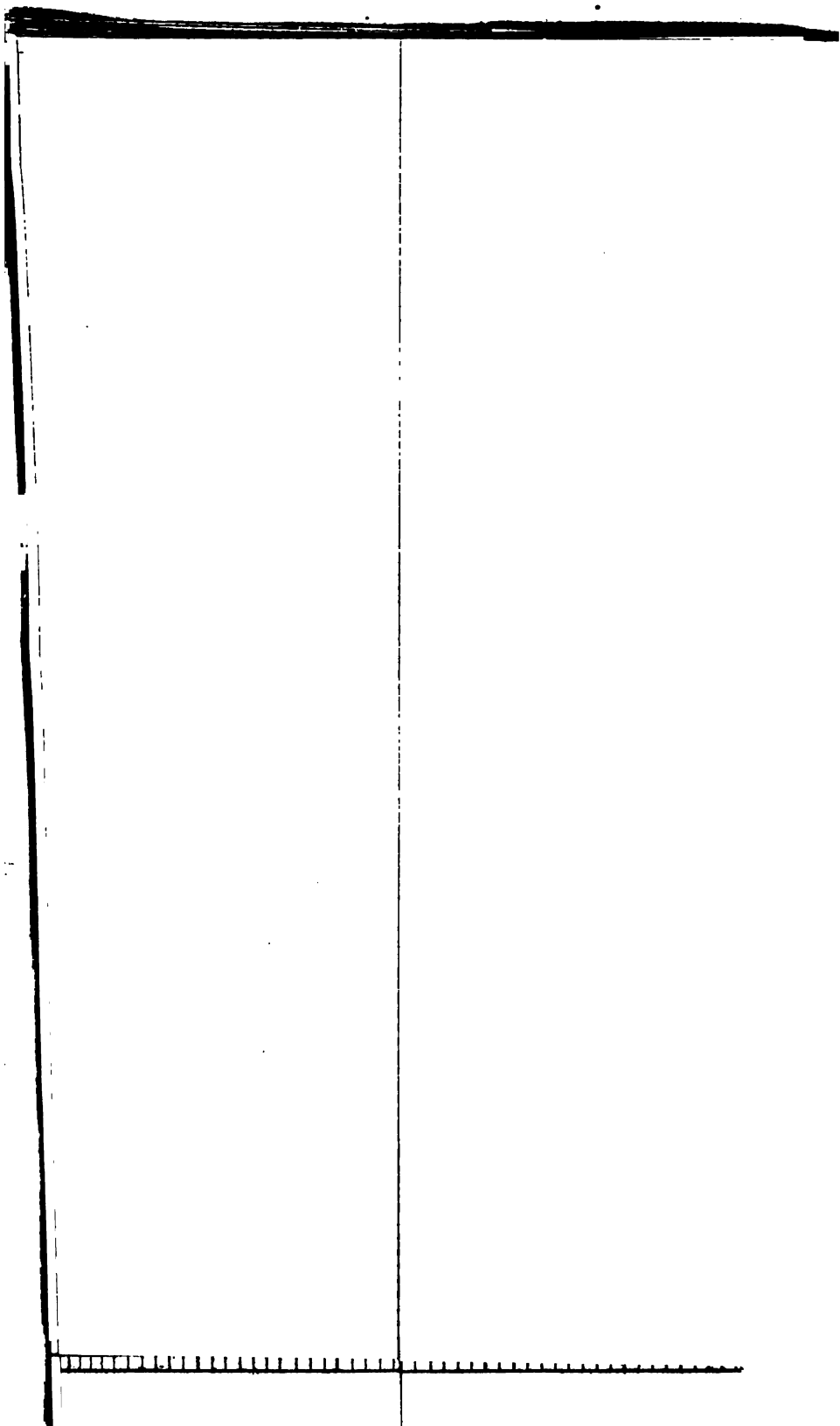


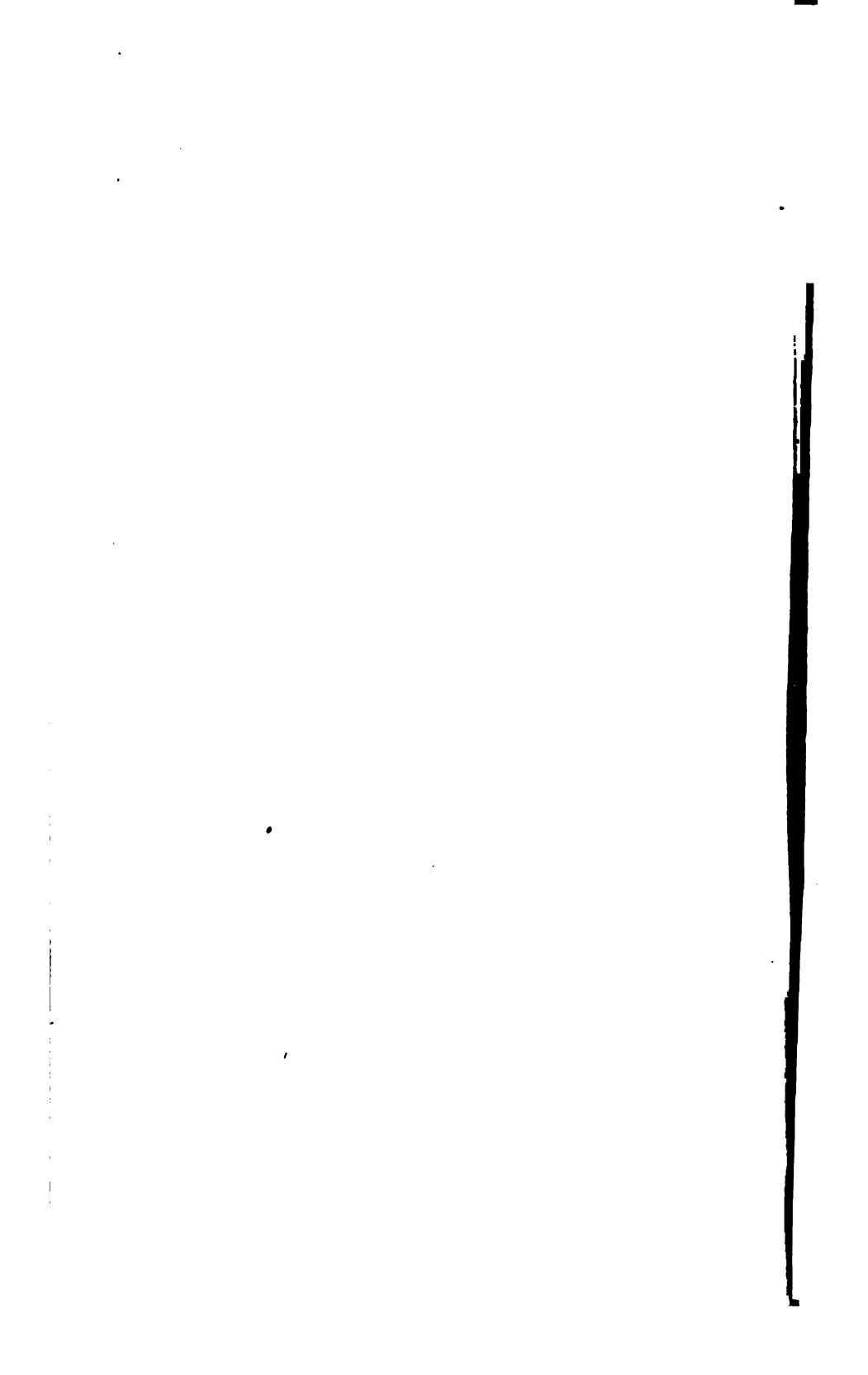


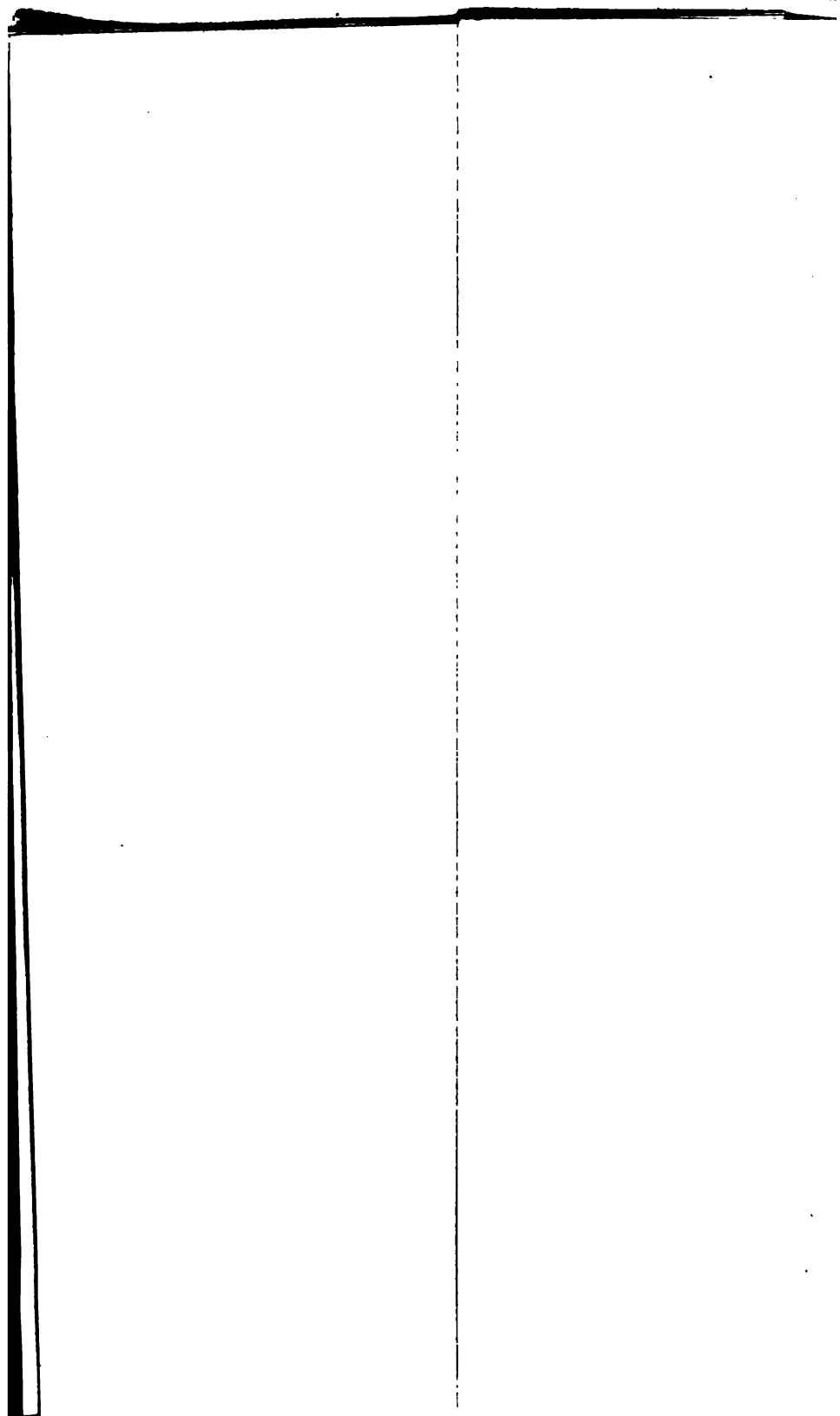


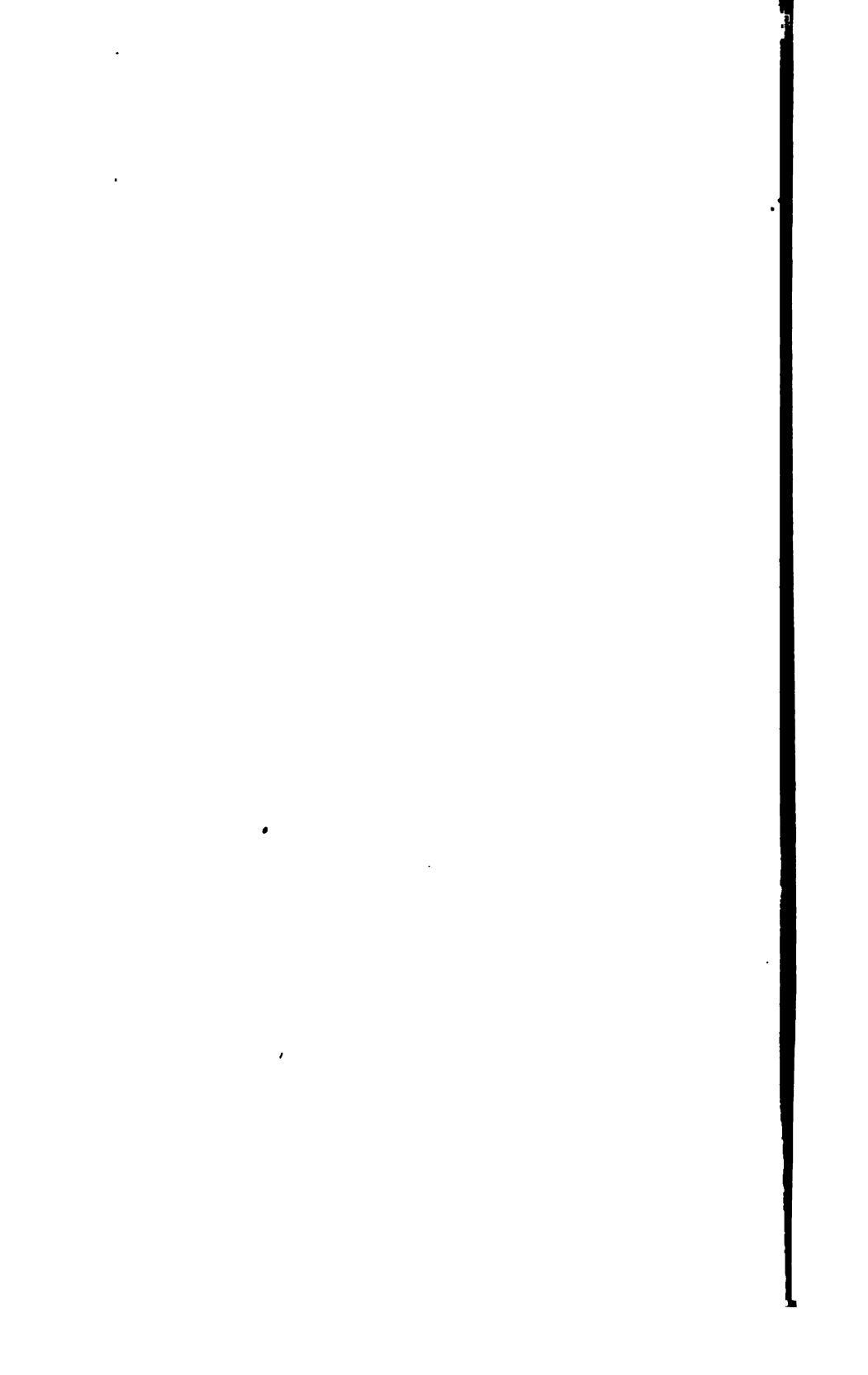
















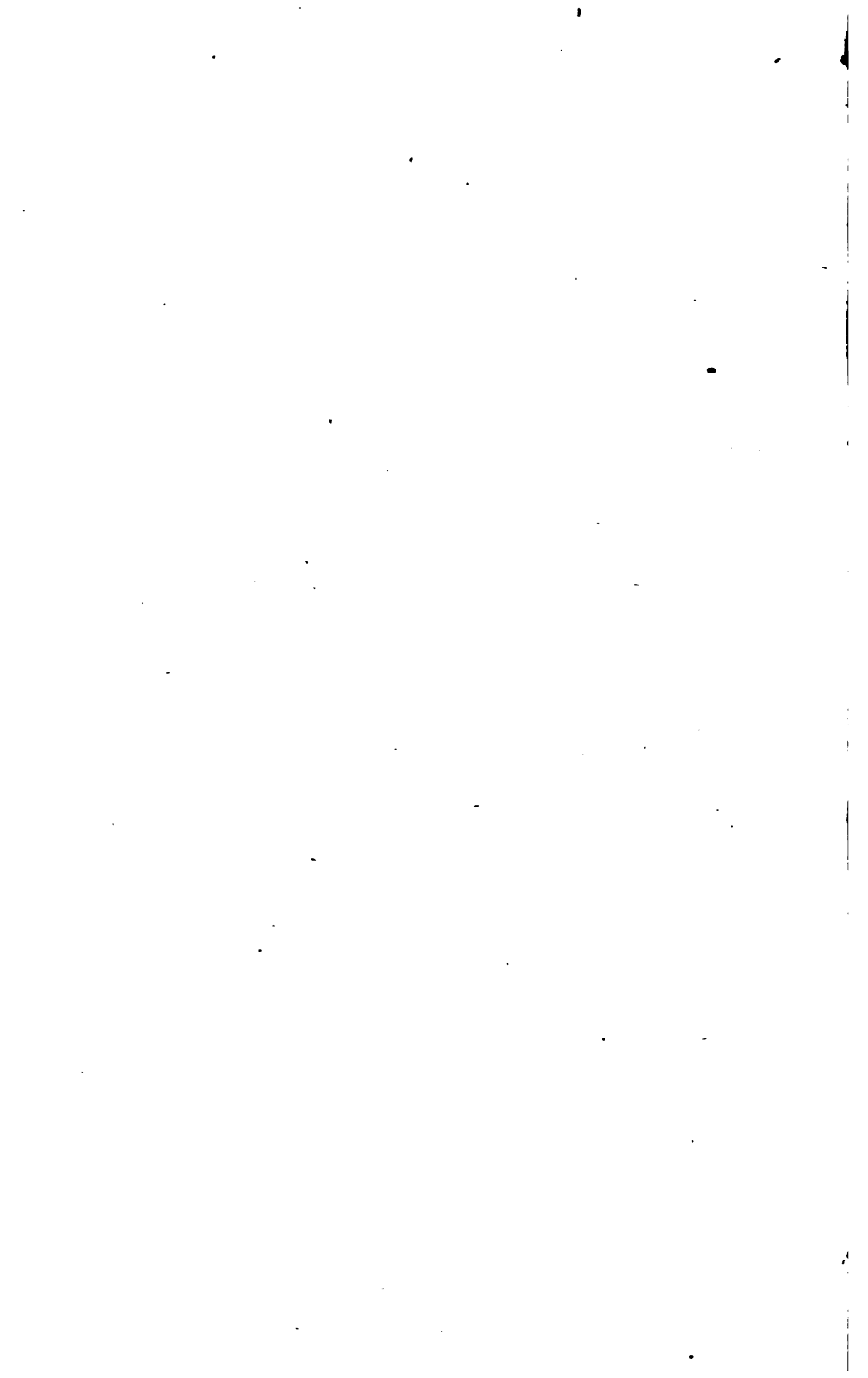
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**ALTERNATE AND REPEATED STRAINING**  
**OF**  
**STEEL, WROUGHT-IRON, AND CAST-IRON BARS.**

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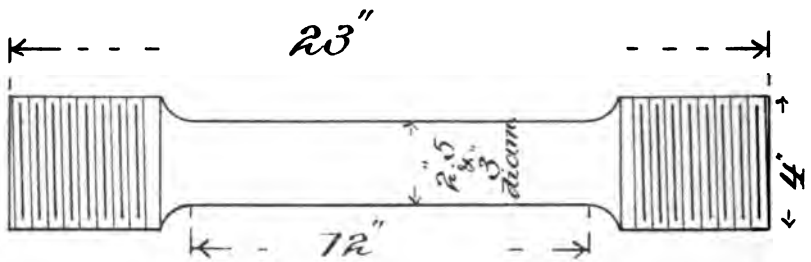
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*Form of specimens for alternate  
Tensile and Compressive stresses*



## CHEMICAL COMPOSITION OF MATERIAL USED IN ALTERNATE STRAINING TESTS.

No. of test.	Material.	Marks.	Carbon.			Man-ganese.	Sili-con.	Sul-phur.	Phos-phorus.	Cop-per.
			Total.	Graph-itic.	Com-bined.					
2764	Steel.....	$\left. \begin{array}{l} S B_1 \\ L_1 M \end{array} \right\}$	0.435	0.085	0.400	0.750	0.151	0.023	0.021	0.010
2760	...do.....	$\left. \begin{array}{l} S B_1 \\ L_1 M \\ N_1 \end{array} \right\}$	0.529	0.049	0.480	0.660	0.193	0.032	0.032	0.017
2761	...do.....	$\left. \begin{array}{l} S B_1 \\ L_1 M \\ N_1 \end{array} \right\}$	0.463	0.017	0.446	0.561	0.160	0.043	0.031	0.020
2762	...do.....	$\left. \begin{array}{l} N 191 \\ R \end{array} \right\}$	0.558	0.027	0.531	0.656	0.195	0.038	0.033	0.018
2763	...do.....	$\left. \begin{array}{l} N 191 \\ R \end{array} \right\}$	0.462	0.020	0.442	0.669	0.169	0.039	0.031	0.022
5762	Steel railroad axle.....		0.156	0.018	0.138	0.834	0.006	0.115	0.092	0.306
5085	Wrought iron.....		0.027	0.002	0.025	None	0.035	0.015	0.105	0.075
5763	Cold rolled iron.....	A.	0.060	None	0.060	None	0.232	0.012	0.123	0.016
5764	...do.....	B.	0.062	None	0.062	None	0.230	0.014	0.136	0.016
5088	Cast iron.....	1b.	2.811	2.301	0.510	0.713	0.653	0.020	0.515	0.068
5516	...do.....	$\left. \begin{array}{l} II B \\ 2 \end{array} \right\}$	2.963	2.762	0.201	0.381	0.767	0.081	0.556	0.006

## No. 2764.

## MIDVALE STEEL BAR.

Marked  $\left. \begin{array}{l} S B_1 \\ L_1 M \end{array} \right\}$ 

(See Report 1889, page 311, for the first part of this test.)

Bar rested three months and three days, then annealed in an oil bath at temperature of 340 F. Maintained at this temperature two hours, then slowly cooled in the oil.

The heating was slowly done, requiring three hours' time.

Measurements taken on three gauged lengths 120° apart before and after annealing.

Number of gauged length.	Before annealing.	After annealing.	Difference.
1.....	<i>Inches.</i> 10.0064	<i>Inches.</i> 10.0060	<i>Inch.</i> -.0004
2.....	10.0022	10.0022	0
3.....	10.0434	10.0435	+.0001
Mean.....	10.0173	10.0173	-.0001

After annealing, the bar rested two years and two months; the test then resumed.

Applied loads.		Under tensile stress.				Under compressive stress.				Remarks.
Total.	Per square inch.	Elongation per inch.	Permanent set per inch.	Successive.	Total.	Successive.	Compression per inch.	Permanent set per inch.	Successive.	
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	
0	0									Micrometer reset to last reading preceding annealing.
35,340	5,000	.00299	.00280	0	-.00289	.00330	-.00280	0		
35,340	5,000	.00315	.00280	0	-.00282	.00368	-.00280	0		
70,680	10,000	.00381	.00280	0	-.00236	.00395	-.00280	0		
106,020	15,000	.00351	.00280	0	-.00221	.00130	-.00280	0		
106,020	15,000	.00365	.00281	.00001	-.00202	.00168	-.00281	0		
141,360	20,000	.00388	.00281	0	-.00185	.00208	-.00281	0		
141,360	20,000	.00408	.00281	0	-.00168	.00245	-.00280	.00001		
247,390	35,000	.00438	.00280	0	-.00142	.00296	-.00280	0		
247,390	35,000	.00460	.00280	.00010	-.00117	.00343	-.00280	.00010		
282,720	40,000	.01332	.01111	.00831						
282,720	40,000									
318,060	45,000									
318,060	45,000									
353,400	50,000									
35,340	5,000									
70,680	10,000									
106,020	15,000									
141,360	20,000									
176,700	25,000									
212,040	30,000									
247,380	35,000									
247,380	35,000									
282,720	40,000									
282,720	40,000									
318,060	45,000									
318,060	45,000									
353,400	50,000									
35,340	5,000	.00108	.00092	.00007	.01080	.00252	.01101	.00010		
70,680	10,000	.00137	.00079	.00008	.01051	.00029	.01089	.00012		
106,020	15,000	.00165	.00078	.00014	.01017	.00034	.01072	.00017		
141,360	20,000	.00202	.00087	.00018	.00972	.00045	.01045	.00027		
176,700	25,000	.00232	.00050	.00025	.00912	.00060	.01004	.00041		
212,040	30,000	.00267	.00067	.00044	.00830	.00082	.00983	.00061		
247,380	35,000	.00319	.00087	.00067	.00712	.00118	.00845	.00098		
282,720	40,000	.00413	.00094	.00074	.00534	.00178	.00690	.00155		
318,060	45,000				.00292	.00252	.00460	.00250		
353,400	50,000				+.00118	.00400	.00085	.00375		
35,340	5,000	.00092	.00092	.00007						
70,680	10,000	.00137	.00079	.00008						
106,020	15,000	.00165	.00078	.00014						
141,360	20,000	.00202	.00087	.00018						
176,700	25,000	.00232	.00050	.00025						
212,040	30,000	.00267	.00067	.00044						
247,380	35,000	.00319	.00087	.00067						
247,380	35,000	.00413	.00094	.00074						



Rested without load seven months.  
 Stem turned down to 2".247 diameter and test completed by tension  
 Sectional area, 3.97 square inches.  
 Gauged length, 10".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.	
3,970	1,000	0.	0.	0.	0.	Initial load. Micrometer reset to zero.
19,850	5,000	.00015	.00015	0.	0.	
39,700	10,000	.00032	.00017	.00001	.00001	
59,550	15,000	.00049	.00017	.00001	0.	
79,400	20,000	.00067	.00018	.00003	.00002	
99,250	25,000	.00089	.00022	.00008	.00005	
119,100	30,000	.00120	.00031	.00021	.00013	
138,950	35,000	.00176	.00056	.00056	.00035	
158,800	40,000	.00280	.00104	.00138	.00082	
178,650	45,000	.00447	.00167	.00282	.00144	
198,500	50,000	.00740	.00293	.00545	.00263	
202,470	51,000	.00801	.00061	.....	.....	
206,440	52,000	.00865	.00064	.....	.....	
210,410	53,000	.00934	.00089	.....	.....	
214,380	54,000	.01051	.00097	.....	.....	
218,350	55,000	.01179	.00128	.00950	.00406	
222,320	56,000	.01308	.00129	.....	.....	
226,290	57,000	.01455	.00147	.....	.....	
230,260	58,000	.01610	.00155	.....	.....	
234,230	59,000	.01824	.00214	.....	.....	
238,200	60,000	.02007	.00183	.01740	.00790	
242,170	61,000	.022	.00183	.....	.....	
246,140	62,000	.024	.002	.....	.....	
250,110	63,000	.026	.002	.....	.....	
254,080	64,000	.030	.004	.....	.....	
258,050	65,000	.033	.003	.....	.....	
262,020	66,000	.036	.003	.....	.....	
265,990	67,000	.038	.002	.....	.....	
269,960	68,000	.042	.004	.....	.....	
273,930	69,000	.046	.004	.....	.....	
277,900	70,000	.050	.004	.....	.....	
281,870	71,000	.056	.006	.....	.....	
285,840	72,000	.063	.007	.....	.....	
289,810	73,000	.070	.007	.....	.....	
293,780	74,000	.085	.015	.....	.....	
297,750	75,000	.109	.024	.....	.....	
300,620	75,470	.144	.035	.....	.....	
241,600	.....	.....	.....	.....	.....	Tensile strength. Load at time of rupture.

General summary.

Tensile strength per square inch of original section.....pounds.. 76.47  
 Elongation per inch after rupture.....inch... .29  
 Reduction in diameter at point of rupture.....do... .75  
 Reduction in area after rupture, per cent of original section..... 56.1  
 Position of rupture.....3".8 from neck  
 Character of broken surface.....silky, with deep radial serrations; surface of stem slightly scamy  
 Elongation of inch sections.....".14, ".19, ".27, ".70", ".66", ".27, ".22, ".17, ".16, ".11

No. 2760.

STEEL BAR.

Marks,  $S^R$ ,  $L^M$

Diameter, 3"; sectional area, 7.068 square inches. } Original.  
 Gauged length, 10".  
 See Report 1889, page 298, and Report 1890, page 687, for earlier parts of this test.  
 Test resumed after resting without load a period of two years and two months.  
 Last load previous to rest, 50,000 pounds per square inch tension.

Applied loads.	Under tensile stress.				Under compressive stress.				Remarks.	
	Per square Inch.	Elongation per inch.		Permanent set per inch.		Compression per inch.		Permanent set per inch.		
		Total.	Successive.	Total.	Successive.	Total.	Successive.	Total.		Successive.
<b>Pounds.</b>	<b>Inch.</b>	<b>Inch.</b>	<b>Inch.</b>	<b>Inch.</b>	<b>Inch.</b>	<b>Inch.</b>	<b>Inch.</b>	<b>Inch.</b>	<b>Inch.</b>	
0	.....	.....	.....	.....	.....	.....	.....	.....	.....	
5,000	.00087	.00144	.00073	-.00002	.00078	.00014	-.00092	0.		
10,000	.00104	.00017	.00073	0.	-.00077	.00011	-.00092	-.00001		
15,000	.00122	.00018	.00074	+.00001	-.00077	.00018	-.00098	-.00003		
20,000	.00139	.00017	.00077	+.00003	-.00078	.00017	-.00098	+.00003		
25,000	.00160	.00021	.00078	.00001	-.00081	.00015	-.00098	+.00003		
30,000	.00180	.00020	.00081	.00003	-.00083	.00019	-.00095	+.00001		
35,000	.00203	.00023	.00083	.00002	+.00022	.00022	-.00090	+.00005		
40,000	.00230	.00027	.00089	.00006	.00057	.00035	-.00075	-.00015		
45,000	.00258	.00028	.00093	.00004	.....	.....	.....	.....		
50,000	.00285	.00027	.00097	.....	.....	.....	.....	.....		
55,000	.00312	.00005	.00095	.....	.....	.....	.....	.....		
60,000	.00340	.00008	.00098	.....	.....	.....	.....	.....		
65,000	.00368	.00006	.00096	.....	.....	.....	.....	.....		
70,000	.00396	.00008	.00098	.....	.....	.....	.....	.....		
75,000	.00424	.00008	.00098	.....	.....	.....	.....	.....		
80,000	.00452	.00007	.00097	.....	.....	.....	.....	.....		
85,000	.00480	.00007	.00097	.....	.....	.....	.....	.....		
90,000	.00508	.00007	.00097	.....	.....	.....	.....	.....		
95,000	.00536	.00007	.00097	.....	.....	.....	.....	.....		
100,000	.00564	.00007	.00097	.....	.....	.....	.....	.....		
105,000	.00592	.00007	.00097	.....	.....	.....	.....	.....		
110,000	.00620	.00007	.00097	.....	.....	.....	.....	.....		
115,000	.00648	.00007	.00097	.....	.....	.....	.....	.....		
120,000	.00676	.00007	.00097	.....	.....	.....	.....	.....		
125,000	.00704	.00007	.00097	.....	.....	.....	.....	.....		
130,000	.00732	.00007	.00097	.....	.....	.....	.....	.....		
135,000	.00760	.00007	.00097	.....	.....	.....	.....	.....		
140,000	.00788	.00007	.00097	.....	.....	.....	.....	.....		
145,000	.00816	.00007	.00097	.....	.....	.....	.....	.....		
150,000	.00844	.00007	.00097	.....	.....	.....	.....	.....		
155,000	.00872	.00007	.00097	.....	.....	.....	.....	.....		
160,000	.00900	.00007	.00097	.....	.....	.....	.....	.....		
165,000	.00928	.00007	.00097	.....	.....	.....	.....	.....		
170,000	.00956	.00007	.00097	.....	.....	.....	.....	.....		
175,000	.00984	.00007	.00097	.....	.....	.....	.....	.....		
180,000	.01012	.00007	.00097	.....	.....	.....	.....	.....		
185,000	.01040	.00007	.00097	.....	.....	.....	.....	.....		
190,000	.01068	.00007	.00097	.....	.....	.....	.....	.....		
195,000	.01096	.00007	.00097	.....	.....	.....	.....	.....		
200,000	.01124	.00007	.00097	.....	.....	.....	.....	.....		
205,000	.01152	.00007	.00097	.....	.....	.....	.....	.....		
210,000	.01180	.00007	.00097	.....	.....	.....	.....	.....		
215,000	.01208	.00007	.00097	.....	.....	.....	.....	.....		
220,000	.01236	.00007	.00097	.....	.....	.....	.....	.....		
225,000	.01264	.00007	.00097	.....	.....	.....	.....	.....		
230,000	.01292	.00007	.00097	.....	.....	.....	.....	.....		
235,000	.01320	.00007	.00097	.....	.....	.....	.....	.....		
240,000	.01348	.00007	.00097	.....	.....	.....	.....	.....		
245,000	.01376	.00007	.00097	.....	.....	.....	.....	.....		
250,000	.01404	.00007	.00097	.....	.....	.....	.....	.....		
255,000	.01432	.00007	.00097	.....	.....	.....	.....	.....		
260,000	.01460	.00007	.00097	.....	.....	.....	.....	.....		
265,000	.01488	.00007	.00097	.....	.....	.....	.....	.....		
270,000	.01516	.00007	.00097	.....	.....	.....	.....	.....		
275,000	.01544	.00007	.00097	.....	.....	.....	.....	.....		
280,000	.01572	.00007	.00097	.....	.....	.....	.....	.....		
285,000	.01600	.00007	.00097	.....	.....	.....	.....	.....		
290,000	.01628	.00007	.00097	.....	.....	.....	.....	.....		
295,000	.01656	.00007	.00097	.....	.....	.....	.....	.....		
300,000	.01684	.00007	.00097	.....	.....	.....	.....	.....		
305,000	.01712	.00007	.00097	.....	.....	.....	.....	.....		
310,000	.01740	.00007	.00097	.....	.....	.....	.....	.....		
315,000	.01768	.00007	.00097	.....	.....	.....	.....	.....		
320,000	.01796	.00007	.00097	.....	.....	.....	.....	.....		
325,000	.01824	.00007	.00097	.....	.....	.....	.....	.....		
330,000	.01852	.00007	.00097	.....	.....	.....	.....	.....		
335,000	.01880	.00007	.00097	.....	.....	.....	.....	.....		
340,000	.01908	.00007	.00097	.....	.....	.....	.....	.....		
345,000	.01936	.00007	.00097	.....	.....	.....	.....	.....		
350,000	.01964	.00007	.00097	.....	.....	.....	.....	.....		
355,000	.01992	.00007	.00097	.....	.....	.....	.....	.....		
360,000	.02020	.00007	.00097	.....	.....	.....	.....	.....		
365,000	.02048	.00007	.00097	.....	.....	.....	.....	.....		
370,000	.02076	.00007	.00097	.....	.....	.....	.....	.....		
375,000	.02104	.00007	.00097	.....	.....	.....	.....	.....		
380,000	.02132	.00007	.00097	.....	.....	.....	.....	.....		
385,000	.02160	.00007	.00097	.....	.....	.....	.....	.....		
390,000	.02188	.00007	.00097	.....	.....	.....	.....	.....		
395,000	.02216	.00007	.00097	.....	.....	.....	.....	.....		
400,000	.02244	.00007	.00097	.....	.....	.....	.....	.....		

Micrometer reset to last reading preceding rest.

No. 2760—Continued.

Applied loads.		Under tensile stress.				Under compressive stress.				Remarks.
Total.	Per square inch.	Elongation per inch.		Permanent set per inch.		Compression per inch.		Permanentset per inch.		
Pounds.	Pounds.	Total.	Successive.	Total.	Successive.	Total.	Successive.	Total.	Successive.	
		Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	
374,604	53,000	.00510	.00176	.00297	.00195					
35,340	5,000					.00281	.00229	.00233	.00004	
70,680	10,000					.00259	.00222	.00228	.00005	
106,020	15,000					.00253	.00026	.00279	.00009	
141,360	20,000					.00206	.00027	.00289	.00010	
176,700	25,000					.00174	.00032	.00252	.00017	
212,040	30,000					.00132	.00042	.00231	.00021	
247,380	35,000					.00077	.00055	.00197	.00034	
282,720	40,000					.00005	.00072	.00147	.00050	
318,060	45,000					.00101	.00106	.00064	.00083	
353,400	50,000					.00274	.00173	.00083	.00146	
35,340	5,000	.00068	.00206	.00083	.00001					
70,680	10,000	.00045	.00023	.00077	.00006					
106,020	15,000	.00022	.00023	.00070	.00011					
141,360	20,000	.00008	.00030	.00058	.00013					
176,700	25,000	.00041	.00033	.00048	.00013					
212,040	30,000	.00082	.00041	.00025	.00021					
247,380	35,000	.00136	.00054	.00008	.00031					
282,720	40,000	.00208	.00072	.00056	.00050					



Rested without load seven months.  
 Stem turned down to 2".262 diameter and test resumed by tension.  
 Sectional area, 4.02 square inches.  
 Gauged length, 10".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i> 4,020	<i>Pounds.</i> 1,000	<i>Inch.</i> 0.	<i>Inch.</i> 0.	<i>Inch.</i> 0.	<i>Inch.</i> 0.	Initial load. Micrometer reset to zero.
20,100	5,000	.00015	.00015	0.	-----	
40,200	10,000	.00081	.00016	.00001	.00001	
60,300	15,000	.00050	.00019	.00001	0.	
80,400	20,000	.00065	.00015	.00001	0.	
100,500	25,000	.00084	.00019	.00001	0.	
120,600	30,000	.00100	.00016	.00001	0.	
140,700	35,000	.00117	.00017	.00001	0.	
160,800	40,000	.00137	.00020	.00001	0.	
164,820	41,000	.00141	.00004	-----	-----	
168,840	42,000	.00145	.00004	-----	-----	
172,860	43,000	.00149	.00004	-----	-----	
176,880	44,000	.00154	.00005	-----	-----	
180,900	45,000	.00159	.00005	.00002	.00001	
184,920	46,000	.00164	.00005	-----	-----	
188,940	47,000	.00172	.00008	-----	-----	
192,960	48,000	.00181	.00009	-----	-----	
196,980	49,000	.00194	.00013	-----	-----	
201,000	50,000	.00218	.00218	.00037	.00035	
205,020	51,000	.00250	.00084	-----	-----	
209,040	52,000	.00288	.00086	-----	-----	
213,060	53,000	.00345	.00059	-----	-----	
217,080	54,000	.00408	.00063	-----	-----	
221,100	55,000	.00490	.00082	.00275	.00238	
225,120	56,000	.00587	.00107	-----	-----	
229,140	57,000	.00715	.00118	-----	-----	
233,160	58,000	.00845	.00130	-----	-----	
237,180	59,000	.01014	.00169	-----	-----	
241,200	60,000	.01175	.00161	.00915	.00640	
245,220	61,000	.01275	.00100	-----	-----	
249,240	62,000	.01425	.00150	-----	-----	
253,260	63,000	.01625	.00200	-----	-----	
257,280	64,000	.01776	.00151	-----	-----	
261,300	65,000	.02005	.00229	.01713	.00798	
265,320	66,000	.022	.00195	-----	-----	
269,340	67,000	.024	.002	-----	-----	
273,360	68,000	.027	.003	-----	-----	
277,380	69,000	.030	.003	-----	-----	
281,400	70,000	.033	.003	-----	-----	
285,420	71,000	.036	.003	-----	-----	
289,440	72,000	.039	.003	-----	-----	
293,460	73,000	.042	.003	-----	-----	
297,480	74,000	.046	.004	-----	-----	
301,500	75,000	.051	.005	-----	-----	
305,520	76,000	.057	.006	-----	-----	
309,540	77,000	.066	.009	-----	-----	
313,560	78,000	.078	.012	-----	-----	
317,580	79,000	.102	.024	-----	-----	
318,540	79,240	.120	.018	-----	-----	Tensile strength.

Local contraction went on under diminished stress after the maximum load had been reached.

The test was discontinued when the total load had fallen to 300,000 unds. At this time the diameter of the stem had contracted to 1".86 the smallest place; hence the stress per square inch on the minimum stion was  $300,000 \div 2.72$  square inches = 110,290 pounds.

The elongation of the inch sections was as follows: ".10, ".13, ".17, ".29, ".42, ".31, ".17, ".14, ".11, ".11.

The bar was removed from the testing machine and the stem turned down to a uniform diameter of 1.844 square inches.

Sectional area, 2.67 square inches.

The elongated inch sections were laid off on the stem as they existed before the bar was turned down.

The test was resumed and rupture completed.

Tensile strength, 249,100 pounds=93,290 pounds per square inch.

Load at time of rupture, 207,000 pounds.

Total elongation, 2".47 in 10 inches=24.7 per cent.

Total elongation of inch sections: ".14, ".13, ".17, ".29, ".42, ".31, ".17, ".14, ".16, ".54\*.

Diameter at fracture, 1".36. Area, 1.45 square inches.

Contraction of area, 45.7 per cent.

Fractured 1".20 from neck. Appearance, silky, interspersed with fine granulation. Serrated surface radiating from the center of the bar.

No. 2761.  
STEEL BAR.

Marks,  $\frac{S}{N}$ ,  $\frac{M}{N}$

Diameter, 3.11. Sectional area, 7.068 square inches. (Original.)  
Gauged length, 10".

(See Report 1889, page 304, for earlier part of this test.)

Test resumed after bar had rested without load two years and three months.

Last load previous to annealing at 1,667° F., and interval of rest, 50,000 pounds per square inch tension. The annealing was done before the interval of rest.

Applied loads.		Under tensile stress.				Under compressive stress.				Remarks.
Total.	Per square inch.	Elongation per inch.		Permanent set per inch.		Compression per inch.		Permanent set per inch.		
		Inch.	Successive.	Total.	Successive.	Inch.	Successive.	Total.	Successive.	
0	Pounds.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	
70,680	0	.00217	.00032	.00185	0	.00153	.00064	.00185	0	
70,680	10,000	.00250	.00097	.00184	.00001	.00122	.00125	.00185	.00001	
141,360	20,000	.00286	.00164	.00183	.00002	.00087	.00189	.00182	.00001	
212,040	30,000	.00306	.00218	.00184	.00002	.00068	.00237	.00184	0	
247,360	35,000	.00325	.00257	.00184	0	.00048	.00257	.00186	.00002	
282,720	40,000	.00390	.00352	.00187	.00017	.00017	.00017	.00187	.00017	
35,240	5,000	.00217	.00017	.00235	.00019	.00019	.00019	.00235	.00019	
70,680	10,000	.00250	.00017	.00250	.00017	.00017	.00017	.00250	.00017	
106,020	15,000	.00286	.00017	.00286	.00017	.00017	.00017	.00286	.00017	
141,360	20,000	.00306	.00017	.00306	.00017	.00017	.00017	.00306	.00017	
176,700	25,000	.00325	.00017	.00325	.00017	.00017	.00017	.00325	.00017	
212,040	30,000	.00352	.00017	.00352	.00017	.00017	.00017	.00352	.00017	
247,360	35,000	.00390	.00017	.00390	.00017	.00017	.00017	.00390	.00017	
282,720	40,000	.00426	.00017	.00426	.00017	.00017	.00017	.00426	.00017	
352,730	45,000	.00491	.00017	.00491	.00017	.00017	.00017	.00491	.00017	
388,060	45,000	.00529	.00017	.00529	.00017	.00017	.00017	.00529	.00017	
247,360	35,000	.00390	.00017	.00390	.00017	.00017	.00017	.00390	.00017	
212,040	30,000	.00289	.00019	.00289	.00019	.00019	.00019	.00289	.00019	Micrometer reset to last reading preceding rest.

No. 2761—Continued.

Applied loads.		Under tensile stress.				Under compressive stress.				Remarks.
Total.	Per square inch.	Elongation per inch.		Permanent set per inch.		Compression per inch.		Permanent set per inch.		
		Total.	Successive.	Total.	Successive.	Total.	Successive.	Total.	Successive.	
		Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	
Pounds.										
176, 700	25, 000	.00271	— .00018	— .00018	— .00018	— .00018	— .00018	— .00018	— .00018	
141, 360	20, 000	.00255	— .00017	— .00017	— .00017	— .00017	— .00017	— .00017	— .00017	
106, 020	15, 000	.00238	— .00016	— .00016	— .00016	— .00016	— .00016	— .00016	— .00016	
70, 680	10, 000	.00220	— .00015	— .00015	— .00015	— .00015	— .00015	— .00015	— .00015	
35, 340	5, 000	.00203	— .00017	.00187	.00001	.00187	.00001	.00187	.00001	
318, 060	45, 000									
325, 128	46, 000	.00354	.00326			.00028		.00175	.00003	
332, 196	47, 000	.00357	.00003							
339, 264	48, 000	.00362	.00005							
346, 332	49, 000	.00368	.00006							
353, 400	50, 000	.00373	.00005	.00190	.00006	.00377	.00006	.00950	.00567	
353, 400	50, 000									
35, 340	5, 000	.00350	.00227	— .00368	.00009					
70, 680	10, 000	.00322	.00023	— .00359	.00009					
106, 020	15, 000	.00298	.00024	— .00347	.00012					
141, 360	20, 000	.00270	.00048	— .00320	.00027					
176, 700	25, 000	.00194	.00056	— .00292	.00038					
212, 040	30, 000	.00115	.00079	— .00227	.00055					
247, 380	35, 000	.00097	.00108	— .00139	.00098					
282, 720	40, 000	.00152	.00007	— .00132	.00132					
318, 060	45, 000	.00390	.00238	— .00210	.00210					
353, 400	50, 000	.00796	.00406	— .00582	.00372					
70, 680	10, 000					.00526	.00270	.00563	.00019	
141, 360	20, 000					.00453	.00073	.00426	.00037	
212, 040	30, 000					.00329	.00124	.00440	.00096	
282, 720	40, 000					.00080	.00249	.00232	.00208	
353, 400	50, 000					.00446	.00526	.00243	.00475	

Metal along one end of stem drawn down, the other end undisturbed.

Rested without load seven months.

Stem turned down to 2". 258 diameter, and test completed by tension.

Sectional area, 4 square inches.

Gauged length, 10".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds. 4,000	Pounds. 1,000	Inch. 0.	Inch. 0.	Inch. 0.	Inch. 0.	Initial load. Micrometer reset to zero.
20,000	5,000	.00015	.00015	0.	.....	
40,000	10,000	.00021	.00016	0.	.....	
60,000	15,000	.00049	.00018	0.	.....	
80,000	20,000	.00066	.00017	.00002	.00002	
100,000	25,000	.00087	.00021	.00005	.00003	
120,000	30,000	.00116	.00029	.00018	.00013	
140,000	35,000	.00169	.00053	.00050	.00032	
160,000	40,000	.00266	.00097	.00129	.00079	
180,000	45,000	.00430	.00184	.00265	.00136	
200,000	50,000	.00688	.00258	.00490	.00225	
204,000	51,000	.00741	.00053	.....	.....	
208,000	52,000	.00796	.00055	.....	.....	
212,000	53,000	.00880	.00084	.....	.....	
216,000	54,000	.00967	.00087	.....	.....	
220,000	55,000	.01070	.00103	.00844	.00354	
224,000	56,000	.01169	.00099	.....	.....	
228,000	57,000	.01280	.00111	.....	.....	
232,000	58,000	.01415	.00135	.....	.....	
236,000	59,000	.01514	.00099	.....	.....	
240,000	60,000	.01755	.00241	.01490	.00646	
244,000	61,000	.019	.00145	.....	.....	
248,000	62,000	.021	.002	.....	.....	
252,000	63,000	.023	.002	.....	.....	
256,000	64,000	.025	.002	.....	.....	
260,000	65,000	.028	.003	.....	.....	
264,000	66,000	.030	.002	.....	.....	
268,000	67,000	.032	.002	.....	.....	
272,000	68,000	.034	.002	.....	.....	
276,000	69,000	.037	.003	.....	.....	
280,000	70,000	.040	.003	.....	.....	
284,000	71,000	.044	.004	.....	.....	
288,000	72,000	.048	.004	.....	.....	
292,000	73,000	.053	.005	.....	.....	
296,000	74,000	.058	.005	.....	.....	
300,000	75,000	.065	.007	.....	.....	
304,000	76,000	.074	.009	.....	.....	
308,000	77,000	.088	.014	.....	.....	
312,000	78,000	.110	.022	.....	.....	
313,280	78,320	.135	.025	.....	.....	Tensile strength.

The test was discontinued after passing the maximum load, when the stress had fallen to 300,000 pounds total load=106,010 pounds per square inch on the minimum section, 1".90 diameter.

The bar then measured as follows:

Elongation in 10 inches, 1".95=19.5 per cent.

Elongation of inch sections, ".13, ".19, ".23, ".38, ".29, ".18, ".15, ".13, ".11, ".11.

Minimum diameter, 1".90. Area, 2.84 square inches.

Contraction of area, 29 per cent.

Bar removed from testing machine and annealed by heating bright red and cooling in the open air.

After cooling, the bar was returned to the testing machine and rupture completed.

Maximum load after annealing, 244,500 pounds=86,400 pounds per square inch on section, which was 1".90 diameter.

Load at time of rupture, 224,000 pounds=79,150 pounds per square inch on 1".90 section, or 125,140 pounds per square inch on fractured section.

Total elongation in 10 inches,  $3''.15=31.5$  per cent.

Elongation of inch sections,  $'' .17$ ,  $'' .25$ ,  $'' .44$ ,  $'' .94^*$ ,  $'' .45$ ,  $'' .25$ ,  $'' .20$ ,  $'' .18$ ,  $'' .17$ ,  $'' .10$ .

Diameter at fracture,  $1''.51$ . Area,  $1.79$  square inches.

Total contraction of area,  $55.2$  per cent.

Fractured  $5''$  from the neck. Appearance, fine granular, radiating from a dull silky spot  $'' .50$  diameter at the circumference of the bar.

No. 2762.

STEEL BAR.

Marks,  $N^{20}$   
 Diameter, 3". Sectional area, 7.068 square inches. } Original.  
 Gauged length, 10".  
 (See Report 1889, page 307, and Report 1890, page 690, for earlier parts of this test.)  
 Bar rested two years and two months without load, and test then resumed.  
 Last load preceding interval of rest, 50,000 pounds per square inch compression.

Applied loads.		Under tensile stress.						Under compressive stress.						Remarks.
Total.	Pounds.	Elongation per inch.		Permanent set per inch.		Successive.	Total.	Compression per inch.		Permanent set per inch.		Successive.		
		Inch.	Successive.	Inch.	Successive.			Inch.	Successive.	Inch.	Successive.			
0	0	—	—	—	—	—	—	—	—	—	—	—	—	
35,340	5,000	.00488	.00019	—	.00507	0.	—	—	—	—	—	—	—	
70,680	10,000	.00471	.00017	—	.00506	.00001	—	—	—	—	—	—	—	
104,020	15,000	.00457	.00014	—	.00502	.00004	—	—	—	—	—	—	—	
141,360	20,000	.00436	.00021	—	.00502	0.	—	—	—	—	—	—	—	
141,360	20,000	—	—	—	—	—	.00502	.00126	.00502	0.	—	—	—	
176,700	25,000	.00418	.00144	—	.00500	.00002	—	—	—	—	—	—	—	
176,700	25,000	—	—	—	—	—	.00576	.00158	.00502	.00002	—	—	—	
212,040	30,000	.00398	.00178	—	.00498	.00004	—	—	—	—	—	—	—	
212,040	30,000	—	—	—	—	—	.00590	.00192	.00501	.00008	—	—	—	
212,040	30,000	.00398	.00192	—	.00497	.00004	—	—	—	—	—	—	—	
212,040	30,000	—	—	—	—	—	.00590	.00192	.00501	.00004	—	—	—	
212,040	30,000	.00395	.00195	—	.00492	.00009	—	—	—	—	—	—	—	After 5 minutes.
212,040	30,000	—	—	—	—	—	.00588	.00184	—	—	—	—	—	Do.
212,040	30,000	.00394	.00091	—	.00492	.00009	.00587	.00001	.00487	.00005	—	—	—	Do.
212,040	30,000	.00394	.00193	—	.00488	.00009	—	—	—	—	—	—	—	After 12 minutes.
212,040	30,000	.00383	.00001	—	.00488	.00001	—	—	—	—	—	—	—	After 20 minutes.
212,040	30,000	.00390	.00002	—	.00488	.00002	—	—	—	—	—	—	—	After 25 minutes.
212,040	30,000	.00389	.00001	—	.00488	.00001	—	—	—	—	—	—	—	After 50 minutes.
212,040	30,000	.00388	.00001	—	.00488	.00001	—	—	—	—	—	—	—	After 70 minutes.
212,040	30,000	.00388	0.	—	.00488	0.	—	—	—	—	—	—	—	After 5 minutes.
212,040	30,000	.00391	.00193	—	.00488	.00009	.00586	.00198	.00482	.00004	—	—	—	After 10 minutes.
212,040	30,000	.00388	.00003	—	.00488	.00003	.00584	.00002	.00482	.00004	—	—	—	

Micrometer reset to last reading preceding rest.





318,060	45,000	—,00087	.00006	—,00286	.00011	.00608	.00511	.00189	After 7 minutes.
318,060	45,000	—,00087	.00006	—,00286	.00011	.00608	.00511	.00189	
318,060	45,000	—,00087	.00549	—,00245	.00210	.00616	.00008	.00455	
318,060	45,000	—,00087	.00549	—,00245	.00210	.00616	.00008	.00455	

Rested without load seven months.  
 Stem turned down to 1".995 diameter, and test completed by tension.  
 Sectional area, 3.12 square inches.  
 Gauged length, 10".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
3, 120	1, 000	0.	0.	0.	0.	
15, 600	5, 000	.00015	.00015	0.	0.	
31, 200	10, 000	.00033	.00018	.00001	.00001	
46, 800	15, 000	.00051	.00018	.00002	.00001	
62, 400	20, 000	.00069	.00018	.00002	0.	
78, 000	25, 000	.00084	.00015	.00002	0.	
93, 600	30, 000	.00100	.00016	.00002	0.	
109, 200	35, 000	.00118	.00018	.00002	0.	
124, 800	40, 000	.00135	.00017	.00002	0.	
140, 400	45, 000	.00155	.00020	.00002	0.	
143, 520	46, 000	.00158	.00003			
146, 640	47, 000	.00162	.00004			
149, 760	48, 000	.00166	.00004			
152, 880	49, 000	.00170	.00004			
156, 000	50, 000	.00175	.00005	.00004	.00002	
159, 120	51, 000	.00180	.00005			
162, 240	52, 000	.00185	.00005			
165, 360	53, 000	.00195	.00010			
168, 480	54, 000	.00220	.00025			
171, 600	55, 000	.00375	.00155	.00172	.00168	
174, 720	56, 000	.00464	.00089			
177, 840	57, 000	.00625	.00161			
180, 960	58, 000	.00730	.00105			
184, 080	59, 000	.00840	.00110			
187, 200	60, 000	.01005	.00165	.00760	.00588	
190, 320	61, 000	.01100	.00095			
193, 440	62, 000	.01223	.00123			
196, 560	63, 000	.01400	.00177			
199, 680	64, 000	.01535	.00135			
202, 800	65, 000	.01675	.00140	.01400	.00640	
205, 920	66, 000	.01825	.00150			
209, 040	67, 000	.01970	.00150			
212, 160	68, 000	.022	.00230			
215, 280	69, 000	.024	.002			
218, 400	70, 000	.026	.002			
221, 520	71, 000	.028	.002			
224, 640	72, 000	.030	.002			
227, 760	73, 000	.033	.003			
230, 880	74, 000	.035	.002			
234, 000	75, 000	.039	.004			
237, 120	76, 000	.042	.003			
240, 240	77, 000	.047	.005			
243, 360	78, 000	.051	.004			
246, 480	79, 000	.059	.008			
249, 600	80, 000	.065	.006			
252, 720	81, 000	.076	.011			
255, 840	82, 000	.090	.014			
258, 900	82, 880	.126	.036			
232, 700						Tensile strength. Load at time of rupture.

General summary.

Tensile strength per square inch of original section..... pounds.. 82, 880  
 Elongation per inch after rupture..... inch.. .202  
 Reduction in diameter at point of rupture..... do... .476  
 Reduction in area after rupture, per cent of original section..... 42  
 Position of rupture..... 4", 4 from neck  
 Character of broken surface..... fine granular, radiating from a dull silky center ".50 diameter  
 Elongation of inch sections..... ".09, ".15, ".26, ".57, ".32, ".18, ".13, ".13, ".11, ".09



No. 2763—Continued.

Applied loads.		Under tensile stress.				Under compressive stress.				Remarks.
Total.	Per square inch.	Elongation per inch.		Permanent set per inch.		Compression per inch.		Permanent set per inch.		
Pounds.	Pounds.	Total.	Successive.	Total.	Successive.	Total.	Successive.	Total.	Successive.	
		Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	
282,720	40,000	.....	.....	.....	.....	.00116	.00036	—	.00015	
85,340	5,000	.0045	.0019	.0027	.0002	.....	.....	.....	.....	
70,680	10,000	.0058	.0015	.0027	0	.....	.....	.....	.....	
106,020	15,000	.0078	.0020	.0025	.0001	.....	.....	.....	.....	
141,360	20,000	.0100	.0022	.0032	.0004	.....	.....	.....	.....	
176,700	25,000	.0123	.0023	.0037	.0005	.....	.....	.....	.....	
212,040	30,000	.0151	.0023	.0045	.0008	.....	.....	.....	.....	
247,380	35,000	.0180	.0029	.0054	.0009	.....	.....	.....	.....	
282,720	40,000	.0225	.0045	.0068	.0014	.....	.....	.....	.....	
318,060	45,000	.0291	.0066	.0120	.0052	.....	.....	.....	.....	
353,400	50,000	.0392	.0101	.0192	.0072	.....	.....	.....	.....	
35,340	5,000	.....	.....	.....	.....	.00199	.00223	—	.00077	
70,680	10,000	.....	.....	.....	.....	.00145	.0024	—	.00185	
106,020	15,000	.....	.....	.....	.....	.00120	.0025	—	.00180	
141,360	20,000	.....	.....	.....	.....	.00092	.0028	—	.00172	
176,700	25,000	.....	.....	.....	.....	.00060	.0032	—	.00160	
212,040	30,000	.....	.....	.....	.....	.00017	.0043	—	.00147	
247,380	35,000	.....	.....	.....	.....	+	.0053	—	.00124	
282,720	40,000	.....	.....	.....	.....	.0102	.0066	—	.00089	
318,060	45,000	.....	.....	.....	.....	.0202	.0100	+	.00042	
353,400	50,000	.....	.....	.....	.....	.0435	.0233	+	.00079	
35,340	5,000	.....	.....	.....	.....	.....	.....	.....	.....	
70,680	10,000	.....	.....	.....	.....	.....	.....	.....	.....	
106,020	15,000	.....	.....	.....	.....	.....	.....	.....	.....	
141,360	20,000	.....	.....	.....	.....	.....	.....	.....	.....	
176,700	25,000	.....	.....	.....	.....	.....	.....	.....	.....	
212,040	30,000	.....	.....	.....	.....	.....	.....	.....	.....	
247,380	35,000	.....	.....	.....	.....	.....	.....	.....	.....	
282,720	40,000	.....	.....	.....	.....	.....	.....	.....	.....	
318,060	45,000	.....	.....	.....	.....	.....	.....	.....	.....	
353,400	50,000	.....	.....	.....	.....	.....	.....	.....	.....	

Reated without load 10 hours.

Rested without load seven months.  
 Stem turned down to 2".254 diameter, and test completed by tension.  
 Sectional area, 3.99 square inches.  
 New gauged length of 10" established.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total	Per square inch.					
<i>Pounds.</i> 3,990	<i>Pounds.</i> 1,000	<i>Inch.</i> 0.	<i>Inch.</i> 0.	<i>Inch.</i> 0.	<i>Inch.</i> 0.	Initial load. Micrometer adjusted to zero.
19,950	5,000	.00013	.00013	0.	.....	
39,900	10,000	.00031	.00018	0.	.....	
59,850	15,000	.00049	.00018	0.	.....	
79,800	20,000	.00064	.00015	0.	.....	
99,750	25,000	.00082	.00018	0.	.....	
119,700	30,000	.00099	.00017	0.	.....	
139,650	35,000	.00118	.00019	0.	.....	
159,600	40,000	.00138	.00020	0.	.....	
179,550	45,000	.00157	.00019	0.	.....	
199,500	50,000	.00178	.00021	0.	.....	
203,490	51,000	.00188	.00005	.....	.....	
207,480	52,000	.00188	.00005	.....	.....	
211,470	53,000	.00198	.00005	.....	.....	
215,460	54,000	.00200	.00007	.....	.....	
219,450	55,000	.00208	.00008	.00005	.00005	
223,440	56,000	.00217	.00009	.....	.....	
227,430	57,000	.00228	.00011	.....	.....	
231,420	58,000	.00248	.00020	.....	.....	
235,410	59,000	.00349	.00101	.....	.....	
239,400	60,000	.00560	.00211	.00312	.00807	
243,390	61,000	.00680	.00120	.....	.....	
247,380	62,000	.00850	.00170	.....	.....	
251,370	63,000	.01015	.00185	.....	.....	
255,360	64,000	.01145	.00130	.....	.....	
259,350	65,000	.01400	.00255	.01110	.00798	
263,340	66,000	.015	.001	.....	.....	
267,330	67,000	.017	.002	.....	.....	
271,320	68,000	.019	.002	.....	.....	
275,310	69,000	.021	.002	.....	.....	
279,300	70,000	.024	.003	.....	.....	
283,290	71,000	.026	.002	.....	.....	
287,280	72,000	.029	.003	.....	.....	
291,270	73,000	.032	.003	.....	.....	
295,260	74,000	.036	.004	.....	.....	
299,250	75,000	.039	.003	.....	.....	
303,240	76,000	.044	.005	.....	.....	
307,230	77,000	.046	.002	.....	.....	
311,220	78,000	.056	.010	.....	.....	
315,210	79,000	.064	.008	.....	.....	
319,200	80,000	.078	.014	.....	.....	
323,190	81,000	.100	.022	.....	.....	
326,000	81,700	.....	.....	.....	.....	Tensile strength.
295,000	.....	.....	.....	.....	.....	Load at time of rupture.

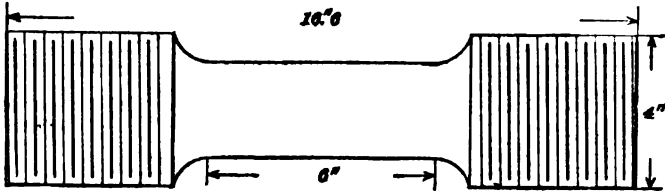
General summary.

Tensile strength per square inch of original section.....	pounds..	81,700
Elongation per inch after rupture.....	inch..	.207
Reduction in diameter at point of rupture.....	do..	.484
Reduction in area after rupture, per cent of original section.....		38.3
Position of rupture.....		3" from neck
Character of broken surface.....	fine granular, radiating from a silky center	.4 in diameter
Elongation of inch sections.....	"10, "11, "12, "13, "15, "16, "25, "53, "36, "16	

No. 5762.

## SPECIMEN FROM STEEL RAILROAD AXLE.

(See Report 1891, page 297, for other tests of this axle.)



Diameter, 2".505.

Sectional area, 4.93 square inches.

Loaded by tension with 197,200 pounds = 40,000 pounds per square inch, which elongated the specimen ".12 in 5 inches.

Also loaded by tension with 246,500 pounds = 50,000 pounds per square inch, which elongated the specimen ".32 total in 5 inches.

Diameter drawn down to 2".429 = 4.634 square inches area; hence the stress per square inch on the reduced section was 53,190 pounds.

Tensile test discontinued.

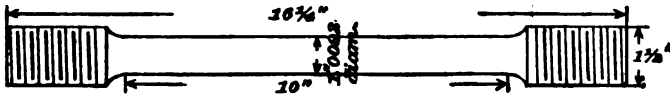
Rested eight days then placed in machine and tested by compression.

Sectional area called 4.93 square inches (original).

Gauged length, 5".32.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Com- pression.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load. Micrometer set at zero.
4,930	1,000	0.	0.	
24,650	5,000	.0004	0.	
49,300	10,000	.0013	0.	
73,950	15,000	.0021	0.	
98,600	20,000	.0030	.0001	
123,250	25,000	.0040	.0001	
147,900	30,000	.0054	.0005	
172,550	35,000	.0078	.0020	
197,200	40,000	.0134	.0064	
221,850	45,000	.0256	.0177	
246,500	50,000	.0584	.0486	
271,150	55,000	.1075	.0970	
295,800	.60,000	.1750	.1634	

Turned down to following dimensions:



Rested 17 days then tested by tension.  
 Sectional area, .80 square inch.  
 Gauged length, 10".

Applied loads.		In gauged length.		Remarks.	
Total.	Per square inch.	Elongation.	Set.		
Pounds.	Pounds.	Inch.	Inch.		
800	1,000	0.	0.	Initial load.	
4,000	5,000	.0014	0.		
8,000	10,000	.0032	0.		
12,000	15,000	.0049	0.		
16,000	20,000	.0065	0.		
20,000	25,000	.0083	0.		
24,000	30,000	.0105	.0005		
28,000	35,000	.0231	.0111		
32,000	40,000	.0449	.0314		
36,000	45,000	.09	.....		
40,000	50,000	.14	.....		
44,000	55,000	.22	.....		
48,000	60,000	.36	.....		
50,200	62,750	.....	.....		Tensile strength. =5.5 per cent.
0	0	.55	.....		

Elongation of inch sections: ".22, ".08, ".02, ".01, ".01, ".00, ".00, ".01, ".06, ".14.

Diameter at fracture, ".90. Area, .636 square inch.

Contraction of area, 20.5 per cent.

Appearance of fracture, granular; three dull spots near the circumference ".15 diameter each.

No. 5085.

WROUGHT IRON BAR.

Diameter, 2".82. Sectional area, 6.246 square inches. } Original.  
 Gauged length, 10". }  
 Test resumed after resting without load two years and one month.  
 (See Report 1890, page 698, for earlier part of this test.)

Applied loads.	Under tensile stress.						Under compressive stress.						Remarks.	
	Elongation per inch.		Permanent set per inch.		Compression per inch.		Permanent set per inch.		Successive.		Successive.			
	Total.	Successive.	Total.	Successive.	Total.	Successive.	Total.	Successive.	Total.	Successive.	Total.	Successive.		
Pounds.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	
6, 246	-.0011	.0030	-.0041	.0007	.0007	.0007	.0007	.0007	.0007	.0007	.0007	.0007	.0007	
62, 460	+.0024	.0103	-.0043	.0007	.0007	.0007	.0007	.0007	.0007	.0007	.0007	.0007	.0007	
62, 460	+	.0103	-.0043	.0007	.0007	.0007	.0007	.0007	.0007	.0007	.0007	.0007	.0007	
124, 920	.0060	.0170	-.0043	.0007	.0007	.0007	.0007	.0007	.0007	.0007	.0007	.0007	.0007	
124, 920	.0097	.0245	-.0043	.0007	.0007	.0007	.0007	.0007	.0007	.0007	.0007	.0007	.0007	
187, 380	.0145	.0332	-.0040	.0007	.0007	.0007	.0007	.0007	.0007	.0007	.0007	.0007	.0007	
187, 380	.0362	.0923	-.0392	.0012	.0012	.0012	.0012	.0012	.0012	.0012	.0012	.0012	.0012	
249, 840	.0315	.0647	-.0353	.0009	.0009	.0009	.0009	.0009	.0009	.0009	.0009	.0009	.0009	
249, 840	.0924	.0661	-.0359	.0024	.0024	.0024	.0024	.0024	.0024	.0024	.0024	.0024	.0024	
312, 300	.0156	.0098	-.0301	.0080	.0080	.0080	.0080	.0080	.0080	.0080	.0080	.0080	.0080	
312, 300	+.0052	.09208	-.0141	.0180	.0180	.0180	.0180	.0180	.0180	.0180	.0180	.0180	.0180	
374, 792	.001	.00048	-.001	.00048	.00048	.00048	.00048	.00048	.00048	.00048	.00048	.00048	.00048	
374, 792	.003	.002	-.003	.002	.002	.002	.002	.002	.002	.002	.002	.002	.002	
349, 776	.021	.018	-.021	.018	.018	.018	.018	.018	.018	.018	.018	.018	.018	
362, 298	.037	.016	-.037	.016	.016	.016	.016	.016	.016	.016	.016	.016	.016	
373, 720														

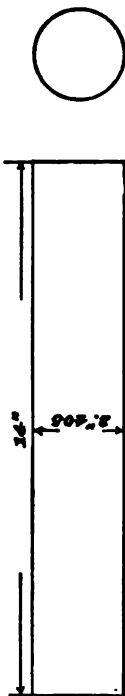
After passing the maximum load local contraction went on under diminished total stress.  
 When the stress had fallen to 350,000 pounds, the test was discontinued.



The minimum diameter was 2''4.2 = 4.60 square inches.  
 Total contraction of area, 26.4 per cent.

The stress per square inch on the reduced section when the test was discontinued was 76,090 pounds.

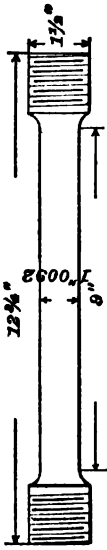
The stem of the bar was now cut off 14 inches long and turned down to 2''405 diameter, and tested by compression.



The place of minimum diameter in the previous tension test was midway the length of the compression specimen.  
 Interval between the tension and the present compression test eight days.  
 Sectional area, 4.54 square inches.  
 Gauged length, 10''.

Applied loads.		Under tensile stress.				Under compressive stress.				Remarks.
Total	Per square inch.	Elongation per inch.		Permanent set per inch.		Compression per inch.		Permanent set per inch.		
	Pounds.	Total	Successive.	Total	Successive.	Total	Successive.	Total	Successive.	
		Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	
4,540	1,000	.....	.....	.....	.....	0.00012	0.00012	0.	0.	Initial load.
23,700	5,000	.....	.....	.....	.....	0.00025	0.00013	0.	0.	
45,400	10,000	.....	.....	.....	.....	0.0042	0.0017	0.00062	0.00062	
68,100	15,000	.....	.....	.....	.....	0.0058	0.0016	0.00072	0.00072	
90,800	20,000	.....	.....	.....	.....	0.0074	0.0015	0.00074	0.00074	
113,500	25,000	.....	.....	.....	.....	0.0093	0.0015	0.00084	0.00084	
136,200	30,000	.....	.....	.....	.....	0.0116	0.0023	0.00116	0.00116	
158,900	35,000	.....	.....	.....	.....	0.0144	0.0028	0.00144	0.00144	
181,600	40,000	.....	.....	.....	.....	0.0183	0.0044	0.00183	0.00183	
204,300	45,000	.....	.....	.....	.....	0.0250	0.0062	0.00250	0.00250	
227,000	50,000	.....	.....	.....	.....	0.0342	0.0092	0.00342	0.00342	
249,700	55,000	.....	.....	.....	.....	0.0462	0.0126	0.00462	0.00462	
272,400	60,000	.....	.....	.....	.....	0.0624	0.0180	0.00624	0.00624	
295,100	65,000	.....	.....	.....	.....	0.0828	0.0252	0.00828	0.00828	
317,800	70,000	.....	.....	.....	.....	0.1068	0.0362	0.01068	0.01068	Set after 5 minutes.
		.....	.....	.....	.....	.....	.....	0.1412	0.0003	

Turned down to tensile specimen.



Sectional area, .80 square inch.  
 Rested seventeen days and tested by tension.  
 Gauged length, 9".

Applied loads.		Under tensile stress.				Under compressive stress.				Remarks.
Total.	Per square inch.	Elongation per inch.		Permanent set per inch.		Compression per inch.		Permanent set per inch.		
Pounds.	inch.	Total.	Successive.	Total.	Successive.	Total.	Successive.	Total.	Successive.	
800		Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Initial load.             Tensile strength.
4,000		0.00014	0.00014	0.	0.					
8,000		0.0033	0.0019	0.	0.					
12,000		0.0051	0.0018	0.	0.					
16,000		0.0070	0.0019	0.	0.0001					
20,000		0.0089	0.0019	0.	0.					
24,000		0.0107	0.0018	0.	0.0001					
28,000		0.0128	0.0021	0.	0.0006					
32,000		0.0151	0.0023	0.	0.0005					
36,000										
40,000										
44,000										
48,570										

Elongation in 9 inches, ".54 = 6 per cent.  
 Elongation of inch sections, ".31\*, ".16, ".02, ".00, ".00, ".00, ".00, ".02, ".01, ".02.  
 Diameter at fracture, ".75. Area, .442 square inch.  
 Contraction of area, 44.8 per cent.  
 Appearance of fracture, fibrous, seamy, 50 per cent granular.

No. 5763.

COLD ROLLED IRON BAR.

Mark, A.  
 Diameter, 3".  
 Sectional area, 7.068 square inches.  
 Gauged length, 10".  
 Specimens A and B were from the same bar, the diameter of which was 3 3/4".

Applied loads.		Under tensile stress.				Under compressive stress.				Remarks.
Total.	Per square inch.	Elongation per inch.		Permanent set per inch.		Compression per inch.		Permanent set per inch.		
		Total.	Successive.	Total.	Successive.	Total.	Successive.	Total.	Successive.	
Pounds.		Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	
0	0	0.	0.	0.	0.	0.	0.	0.	0.	
70,680	10,000	.00030	.00030	0.	0.	.00028	.00058	0.	0.	
70,680	10,000	.00066	.00094	0.	0.	.00063	.00129	0.	0.	
141,360	20,000	.00103	.00166	0.	0.	.00102	.00205	0.	0.	
141,360	20,000	.00147	.00249	0.	0.	.00160	.00307	.00020	.00020	
212,040	30,000	.00011	.00171	—	.00001	.00052	.00063	.00022	.00063	
212,040	30,000	.00045	.00097	—	.00003	.00084	.00129	.00022	.00063	
282,720	40,000	.00085	.00169	—	.00004	.00120	.00205	.00019	.00041	
282,720	40,000	.00132	.00252	—	.00005	.00163	.00296	.00023	.00009	
282,720	40,000									

Removed from testing machine.

Gauged length now measures 9".9975 when referred to standard bar. Stem turned down to 2".522 diameter, 9".12 long, after which the gauged length measured 9".9958; indicating a shortening of ".0017 in a length of 9".12. The compression stress corresponding to this strain is 5,470 pounds per square inch.

Sectional area, 5 square inches. Gauged length, 9".

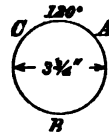
Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.	
0	0	0.	0.	0.	0.	
200,000	40,000	.001	.001	.....	.....	
225,000	45,000	.001+	.0000+	.....	.....	
250,000	50,000	.002	.001	.....	.....	
260,000	52,000	.006	.004	.....	.....	
265,000	53,000	.007	.001	.....	.....	
270,000	54,000	.017	.010	.....	.....	
275,000	55,000	.024	.007	.....	.....	
280,000	56,000	.033	.009	.....	.....	
285,000	57,000	.043	.010	.....	.....	
290,000	58,000	.063	.020	.....	.....	
291,060	58,210	.....	.....	.....	.....	Tensile strength.
259,800	.....	.....	.....	.....	.....	Lead at time of rupture.

*General summary.*

Tensile strength per square inch of original section.....	pounds..	58,210
Elongation per inch after rupture.....	inch..	.143
Reduction in diameter at point of rupture.....	do..	.402
Reduction in area after rupture, per cent of original section.....		29.4
Character of broken surface.....	granular, 60 per cent; fibrous, 40 per cent	
Elongation of inch sections.....	".04, ".06, ".10, ".15, ".21, ".45*, ".15, ".09, ".04	

NOTE.—The age of this cold-rolled metal was not definitely known. It was, however, more than sixteen months old at the time of making the tests.

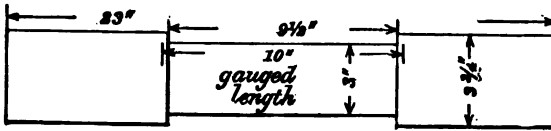
Before turning down into the form of specimen for alternate stresses the internal strains in specimen A were investigated as follows:



Three gauged lengths 120° apart, laid off on bar, and measured as follows:

A	B	C
Inches. 10.0042	Inches. 10.0010	Inches. 10.0028

The bar was now turned down to 3" diameter, a length of 9 1/2" symmetrical with the gauged lengths, and measurements again taken as follows:



A	B	C
Inches. 10.0005	Inches. 9.9978	Inches. 9.9908

The bar therefore shortened along the gauged lengths.

A	B	C
Inch. .0087	Inch. .0032	Inch. .0030

Mean contraction, ".0033.

As this contraction occurred in the length 9 1/2" where the bar was turned down in diameter, the corresponding mean compressive stress, assuming a modulus of elasticity of 27,000,000 pounds per square inch, was 9,379 pounds per square inch.

The sectional area of the annular ring of metal cut away being (11.0447-7.0686) 3.9761 square inches, this compressive stress represents the gross load, 37,290 pounds.

No. 5764.

COLD ROLLED IRON BAL.

Mark, B.  
Diameter, 3".  
Sectional area, 7.068 square inches.  
Gauged length, 10".

Applied loads.		Under tensile stress.				Under compressive stress.				Remarks.
Total.	Per square inch.	Elongation per inch.		Permanent set per inch.		Compression per inch.		Permanent set per inch.		
Pounds.	Pounds.	Total.	Inch. 0.	Successive.	Total.	Inch. 0.	Successive.	Total.	Inch. 0.	Successive.
0	0	Inch. 0.	.00035	0.	Inch. 0.	.00035	0.	Inch. 0.	.00035	0.
70,680	10,000	.00070	.00105	.00001	.00001	.00070	.00001	.00001	.00001	.00001
141,360	20,000	.00108	.00174	.00003	.00003	.00108	.00003	.00003	.00003	.00002
212,040	30,000	.00153	.00261	.00005	.00005	.00108	.00006	.00001	.00004	.00004
282,720	40,000	.00137	.00303	.00012	.00009	.00160	.00321	.00021	.00026	.00026
282,720	40,000	.00013	.00180	.00021	.00001	.00167	.00304	.00022	.00010	.00010
141,360	20,000	.00050	.00109	.00021	0.	.00059	.00072	.00021	0.	0.
141,360	20,000	.00089	.00181	.00020	.00001	.00092	.00142	.00021	0.	0.
212,040	30,000	.00176	.00302	.00002	.00023	.00126	.00215	.00021	.00001	.00001
318,060	45,000	.00189	.00184	.00153	0.	.00117	.00072	.00153	.00001	.00001
853,400	50,000	.00224	.00107	.00152	0.	.00077	.00147	.00145	.00007	.00007
70,680	10,000	.00259	.00183	.00147	.00003	.00025	.00234	.00131	.00016	.00016
141,360	20,000	.00295	.00270	.00141	.00010	.00064	.00350	.00084	.00057	.00057
212,040	30,000	.00287	.00331	.00110	.00026					

Bar removed from machine.

Gauged length now measures 10".0165 when referred to the standard bar.

Stem turned down to 2".520 diameter by 9".16 long.

Gauged length after turning down stem 10".0150, indicating a shortening of ".0015 in 9".16.

The bar was heated full cherry red and cooled in the open air; one end reached a higher temperature, a bright red.

Again placed in the testing machine and test completed by tension.

Diameter, 2".520.

Sectional area, 4.98 square inches. Gauged length, 9".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i> 4,980	<i>Pounds.</i> 1,000	<i>Inch.</i> 0.	<i>Inch.</i> 0.	<i>Inch.</i> 0.	<i>Inch.</i> 0.	Micrometer adjusted to zero.
49,800	10,000	.000389	.000389	.000044	.000044	
99,800	20,000	.000822	.000433	.000078	.000034	
119,820	24,000	-----				Elastic limit. Approximate.
124,500	25,000	.002879	.001857	.001745	.001667	
129,480	26,000	.004400	.001721	.....	.....	
134,460	27,000	.006056	.001856	.....	.....	
139,440	28,000	.008833	.002777	.....	.....	
144,420	29,000	.011500	.002667	.....	.....	
149,400	30,000	.014356	.002556	.013111	.011366	
152,360	32,000	.0211	.006744	.....	.....	
169,320	34,000	.0300	.0089	.....	.....	
179,280	36,000	.0379	.0079	.....	.....	
189,240	38,000	.0511	.0132	.....	.....	
199,200	40,000	.0678	.0167	.....	.....	
209,160	42,000	.0878	.0200	.....	.....	
219,120	44,000	.1333	.0455	.....	.....	
224,950	45,170	.2144	.0811	.....	.....	Tensile strength.

Immediately after reaching the tensile strength there was a brief interruption in the progress of stretching to allow an opportunity to measure the total stretch of the bar at that time.

Upon resuming the test it was found that 224,950 pounds total load, which in the first instance was causing continuous stretching, did not now cause any further elongation.

The load was gradually increased to 227,500 pounds when rapid stretching was again resumed. The load then began to fall slowly as stretching proceeded, and the test was again discontinued when the load had fallen to 225,000 pounds—the total elongation at the time being 2".13.

A rest of fifteen hours without load was given the bar for the purpose of ascertaining the effect of this additional rest upon the tensile resistance.

Under earlier stresses, but after the bar had received a considerable permanent set, the metal was observed to possess a decided tendency to display periods of rigidity under increased stresses if the stretching was not continuous.

After a rest of fifteen hours without load the test was resumed.

The tensile stress was increased to 253,700 pounds before rapid stretching was renewed.

The stress slowly fell to 250,000 pounds when the total stretch had reached 2".15 in 9 inches. Then the load was released and the bar taken from the testing machine.

Test resumed after resting forty-two days.

Tensile strength 260,100 pounds=52,230 pounds per square inch on the original section.

Total elongation in 9 inches 2".55=28.3 per cent.

Diameter at fracture, 2".03. Area, 3.24 square inches.

Contraction of area, 34.9 per cent.

Appearance of fracture, granular 60 per cent; fibrous center 40 per cent.

No. 5088.

CAST IRON BAR.

Marks, 1b.  
 Diameter, 3". Sectional area, 7.068 square inches. } Original.  
 Gauged length, 10".  
 Test resumed after a rest of seventeen months.  
 (See Report 1890, p. 708, for earlier part of this test.)

[This and succeeding cast iron specimens, excepting sand casting No. 2770, were all from the same casting.]

Applied loads.		Under tensile stress.				Under compressive stress.				Remarks.	
Total.	Per square inch.	Elongation per inch.		Permanent set per inch.		Compression per inch.		Permanent set per inch.			
Pounds.	Pounds.	Total.	Inch.	Total.	Inch.	Total.	Inch.	Total.	Inch.	Total.	Inch.
0	0										
35,340	5,000	—	.01295	—	.01228	—	.00007	—	.00004	—	.00004
70,680	10,000	—	.01147	—	.00658	—	.00080	—	.00337	—	.00337
106,020	15,000	—	.01053	—	.00484	—	.00463	—	.00355	—	.00355
141,360	20,000	—	.00910	—	.00143	—	.00105	—	.00448	—	.00448
176,700	25,000	—	.00793	—	.00297	—	.00162	—	.00441	—	.00441
35,340	5,000								.00960		.00960
70,680	10,000								.00837		.00837
106,020	15,000								.00692		.00692
141,360	20,000								.01040		.01040
176,700	25,000								.01081		.01081
312,040	30,000								.01129		.01129
247,880	25,000								.01180		.01180
282,720	40,000								.01240		.01240
85,340	5,000										
70,680	10,000										
106,020	15,000										
141,360	20,000										
176,700	25,000										
85,340	5,000										
141,360	20,000										
282,720	40,000										

Micrometer adjusted to last reading preceding the period of rest.



Bar removed from testing machine and annealed between hot plates.  
 Expansion  $\frac{1}{1000}$  in length of 9".  
 Estimated temperature, 1,124° F.  
 Bar rested eight days after annealing, test then resumed.

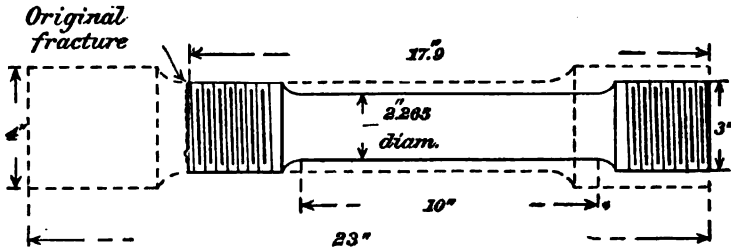
0		—, 01010		0.		Micrometer set to last reading preceding the annealing.		Tensile strength.	
85, 340	5, 000	—, 00984	00926	—, 01010	0.	00948	00005		
70, 680	10, 000	—, 00982	00923	—, 01008	0.	00957	00000		
108, 020	15, 000	—, 00916	00926	—, 01008	0.	00970	00013		
141, 860	20, 000	—, 00865	00951	—, 00986	0.	00982	00012		
178, 700	25, 000	—, 00786	00979	—, 00942	0.	01004	00012		
85, 340	5, 000					00973	00186		
70, 680	10, 000					01010	00038		
108, 020	15, 000					01048	00038		
141, 860	20, 000					01080	00042		
178, 700	25, 000					01126	00020		
						01150	00024		
85, 340	5, 000					01184	00035		
70, 680	10, 000					01228	00039		
85, 340	5, 000	—, 00898	00247	—, 01015	00012				
70, 680	10, 000	—, 00846	00849	—, 01005	00010				
108, 020	15, 000	—, 00801	00845	—, 00892	00013				
141, 860	20, 000	—, 00857	00844	—, 00870	00022				
178, 700	25, 000	—, 00791	00066	—, 00897	00033				
178, 860	25, 450								

Fractured at the neck.

Appearance of fracture, uniform granular, except at the circumference there were dark colored spots extending  $''05$  to  $''08$  toward the center of the bar.

The cause of these dark colored spots is unknown, but their presence may be due to cracks which existed before annealing, and were discolored at that time.

Fractured end turned down to a smaller specimen and again tested by tension.



Sectional area, 4.03 square inches.

Tensile strength, 116,560 pounds = 28,920 pounds per square inch.

Fractured  $9\frac{3}{4}''$  from original fracture, or  $4\frac{1}{4}''$  from neck of present specimen.

Appearance of fracture, uniform granular.

No. 5510.

CAST IRON BAR.

M I, one end.  
 Marks, B II, one end.  
 Diameter, 2 7/8". Sectional area, 4.91 square inches.  
 Gauged length, 10".

Applied loads.		Under tensile stress.				Under compressive stress.				Remarks.
Total.	Per square inch.	Elongation per inch.	Permanent set per inch.	Successive.	Total.	Successive.	Compression per inch.	Permanent set per inch.	Successive.	
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	
0	0	0	0	0	0	0	0	0	0	
24, 550	5, 000	.00027	-.00002	-.00002	-.00032	.00175	-.00051	-.00010	.00010	
49, 100	10, 000	.00053	-.00026	0	-.00005	.00037	-.00036	-.00015	.00015	
73, 650	15, 000	.00086	+.00004	0	+.00041	.00096	-.00023	-.00013	.00013	
98, 200	20, 000	.00128	+.00042	+.00008	+.00084	.00043	-.00008	-.00017	.00017	
122, 750	25, 000	.00207	.00061	.00039	.00127	.00043	+.00010	.00016	.00016	
24, 550	5, 000									
49, 100	10, 000									
73, 650	15, 000									
98, 200	20, 000									
122, 750	25, 000									
24, 550	5, 000	.00027	-.00002	.00008	-.00002	.00154	-.00002	-.00008	.00008	
49, 100	10, 000	.00060	+.00004	.00006	+.00004	.00033	-.00004	-.00006	.00006	
73, 650	15, 000	.00100	.00014	.00010	.00014	.00040	.00010	.00010	.00010	
98, 200	20, 000	.00146	.00031	.00017	.00031	.00046	.00017	.00017	.00017	
122, 750	25, 000	.00208	.00052	.00029	.00052	.00052	.00029	.00029	.00029	
24, 550	5, 000									
49, 100	10, 000									
73, 650	15, 000									
98, 200	20, 000									
122, 750	25, 000									
24, 550	5, 000	.00028	-.00002	.00008	-.00028	.00180	-.00047	-.00013	.00013	
49, 100	10, 000	.00057	+.00007	.00006	+.00007	.00035	-.00037	-.00010	.00010	
73, 650	15, 000	.00086	+.00010	.00006	+.00010	.00040	-.00021	-.00013	.00013	
98, 200	20, 000	.00122	.00006	.00006	.00006	.00039	-.00008	-.00013	.00013	
122, 750	25, 000	.00178	.00011	.00011	.00011	.00043	+.00011	.00019	.00019	
147, 300	30, 000	.00257	.00018	.00018	.00018	.00049	+.00038	.00025	.00025	
171, 850	35, 000	.00350	.00027	.00027	.00027	.00079	+.00068	.00052	.00052	
196, 400	40, 000	.00417	.00041	.00041	.00041	.00160	+.00214	.00126	.00126	
24, 550	5, 000	-.00167	-.00194	.00150	-.00167					
49, 100	10, 000	-.00117	-.00172	.00050	-.00117					

No. 5510—Continued.

Applied loads.		Under tensile stress.				Under compressive stress.				Remarks.
		Elongation per inch.		Permanent set per inch.		Compression per inch.		Permanent set per inch.		
Total.	Per square inch.	Total.	Successive.	Total.	Successive.	Total.	Successive.	Total.	Successive.	
	Pounds.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	
73, 650	15, 000	-.00050	.00087	-.00134	.00038	.00087	.00017	.00003	.00009	
86, 200	20, 000	+.00039	.00089	-.00078	.00056	.00047	.00014	.00038	.00021	
123, 750	25, 000	.00158	.00119	+.00006	.00084	.00114	.00001	.00001	.00023	
24, 550	5, 000					.00080	.0188	.00003	.00009	
49, 100	10, 000					.00087	.0087	.00017	.00017	
73, 650	15, 000					.00114	.00047	.00038	.00021	
98, 200	20, 000					.00163	.00048	.00001	.00023	
123, 750	25, 000					.00212	.00050	.00086	.00025	
147, 300	30, 000					.00287	.00025	.00114	.00028	
171, 850	35, 000					.00327	.00090	.00184	.00040	
196, 400	40, 000					.00426	.00069	.00222	.00068	
220, 950	45, 000					.00476	.00250	.00435	.00213	
245, 500	50, 000					.00481	.00305	.00712	.00277	
24, 550	5, 000	-.00656	.00325	-.00681	.00031	.00059	.00339	.00359	.00004	
49, 100	10, 000	-.00597	.00059	-.00648	.00033	.00470	.00372	.00372	.00013	
73, 650	15, 000	-.00610	.00087	-.00698	.00058	.00445	.00387	.00415	.00015	
98, 200	20, 000	-.00382	.00128	-.00498	.00082	.00515	.00445	.00497	.00020	
123, 750	25, 000	-.00294	.00178	-.00355	.00143	.00565	.00432	.00432	.00025	
147, 300	30, 000					.00615	.00050	.00459	.00027	
171, 850	35, 000					.00715	.00060	.00493	.00031	
196, 400	40, 000					.00745	.00070	.00537	.00044	
220, 950	45, 000					.00834	.00089	.00598	.00061	
245, 500	50, 000					.00974	.00140	.00704	.00106	
270, 050	55, 000					.01314	.00340	.01005	.00301	
294, 600	60, 000					.01769	.00448	.01411	.00406	
24, 550	5, 000	-.01353	.00409	-.01378	.00039					
49, 100	10, 000	-.01285	.00068	-.01326	.00042					
73, 650	15, 000	-.01190	.00095	-.01270	.00096					
98, 200	20, 000	-.01049	.00141	-.01165	.00106					
123, 750	25, 000	-.00856	.00194	-.01005	.00160					

Rested 16 hours.

24, 550	5, 000	.01042	.00187	.01013	.00008
49, 100	10, 000	.01077	.00035	.01024	.00011
73, 650	15, 000	.01117	.00040	.01054	.00010
98, 200	20, 000	.01159	.00043	.01050	.00016
122, 750	25, 000	.01204	.00045	.01087	.00017
147, 300	30, 000	.01248	.00044	.01087	.00020
171, 850	35, 000	.01297	.00049	.01110	.00023
196, 400	40, 000	.01352	.00055	.01139	.00029
220, 950	45, 000	.01417	.00065	.01176	.00037
245, 500	50, 000	.01491	.00074	.01221	.00045
270, 050	55, 000	.01590	.00099	.01288	.00087
294, 600	60, 000	.01744	.00154	.01404	.00116
319, 150	65, 000	.02215	.00471	.01854	.00430
343, 700	70, 000	.03117	.00902	.02585	.00751
24, 550	5, 000				
49, 100	10, 000		.00585		
73, 650	15, 000		.00081		
98, 200	20, 000		.00101		
122, 750	25, 000		.00141		
147, 300	30, 000				
171, 850	35, 000				
196, 400	40, 000				
220, 950	45, 000				
245, 500	50, 000				
270, 050	55, 000				
294, 600	60, 000				
319, 150	65, 000				
343, 700	70, 000				
24, 550	5, 000		.02532		
49, 100	10, 000		.02451		
73, 650	15, 000		.02350		
98, 200	20, 000		.02209		
122, 750	25, 000				
147, 300	30, 000				
171, 850	35, 000				
196, 400	40, 000				
220, 950	45, 000				
245, 500	50, 000				
270, 050	55, 000				
294, 600	60, 000				
319, 150	65, 000				
343, 700	70, 000				
24, 550	5, 000		.02557	.00228	
49, 100	10, 000		.02502	.00055	
73, 650	15, 000		.02432	.00070	
98, 200	20, 000		.02324	.00108	
122, 750	25, 000				
147, 300	30, 000				
171, 850	35, 000				
196, 400	40, 000				
220, 950	45, 000				
245, 500	50, 000				
270, 050	55, 000				
294, 600	60, 000				
319, 150	65, 000				
343, 700	70, 000				

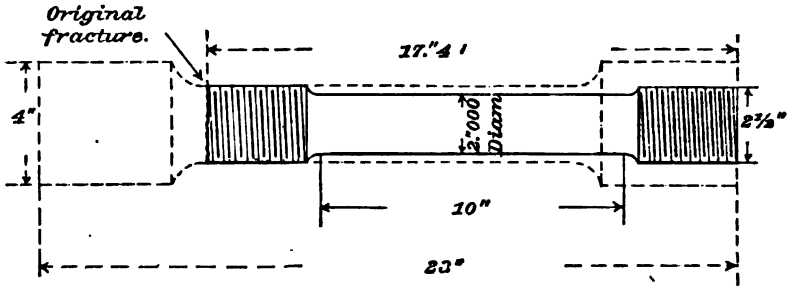
Bar deflected convex on the micrometer side.

Tensile strength.

Fractured at the neck. Appearance, uniform granular.

Minute cracks developed, visible on the surface of the stem, taking irregular zigzag directions.

Fractured end turned down to a smaller specimen and again tested by tension.



Sectional area, 3.14 square inches.

Tensile strength, 86,980 pounds = 27,700 pounds per square inch.

Fractured  $6\frac{1}{2}$ " from original fracture, or  $2\frac{3}{4}$ " from neck of present specimen.

The present fracture occurred 1" inside the neck on the original specimen.

Appearance of fracture, uniform granular.

No. 5515.

CAST IRON BAR.

Marks,  $M_{11-3}$   
 Diameter, 2" .500.  
 Sectional area, 4.91 square inches.  
 Gauged length, 10".

Applied loads.		Under tensile stress.				Under compressive stress.				Remarks.
Total.	Per square inch.	Total.	Successive.	Total.	Successive.	Total.	Successive.	Total.	Successive.	
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	
0	0	0.	0.	0.	0.	0.	0.	0.	0.	
24,550	5,000	.00025	.00003	-.00003	-.00003	-.00003	-.00003	0.	0.	
40,100	10,000	.00054	.00029	-.00002	+.00001	0.	0.	0.	0.	
74,650	15,000	.00085	.00031	+.00003	.00001	0.	0.	0.	0.	
86,200	20,000	.00128	.00043	.00015	.00012	0.	0.	0.	0.	
122,750	25,000	.00207	.00079	.00058	.00043	0.	0.	0.	0.	
24,550	5,000					-.00031	.00176	-.00050	.00009	
40,100	10,000					+.00003	.00036	-.00036	.00014	
74,650	15,000					.00037	.00017	-.00024	.00012	
86,200	20,000					.00080	.00038	-.00010	.00014	
122,750	25,000					.00121	.00041	+.00007	.00017	
24,550	5,000	.00027	.00148	0.	.00007	0.	.00007	0.	0.	
40,100	10,000	.00051	.00034	-.00007	.00007	0.	.00007	0.	0.	
74,650	15,000	.00100	.00039	.00017	.00010	0.	.00010	0.	0.	
86,200	20,000	.00148	.00048	.00032	.00015	0.	.00015	0.	0.	
122,750	25,000	.00210	.00062	.00059	.00027	0.	.00027	0.	0.	
24,550	5,000	.00030	.00020	.00002	.00005	.00120	.00030	.00003	.00002	
40,100	10,000	.00065	.00035	.00010	.00006	0.	0.	0.	0.	
74,650	15,000	.00103	.00038	.00019	.00009	0.	0.	0.	0.	
86,200	20,000	.00150	.00047	.00035	.00016	0.	0.	0.	0.	
122,750	25,000	.00210	.00060	.00059	.00024	0.	0.	0.	0.	

Loaded with 25,000 pounds per square inch compressive stress five times, alternately with the same tensile stress, the tensile stress being applied four times, the last loading being in the compression direction.

No. 5515—Continued.

Applied loads.		Under tensile stress.				Under compressive stress.				Remarks.
		Elongation per inch.		Permanent set per inch.		Compression per inch.		Permanent set per inch.		
		Total.	Successive.	Total.	Successive.	Total.	Successive.	Total.	Successive.	
Pounds.	Per square inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	
122,750	25,000	.....	.....	.....	.....	.....	.....	.....	.....	
24,550	5,000	.00396	.00385	.00098	.0007	.....	.....	.....	.....	
49,100	10,000	.0071	.00388	.0019	.007	.....	.....	.....	.....	
73,650	15,000	.0110	.0039	.0025	.0010	.....	.....	.....	.....	
98,200	20,000	.0156	.0045	.0039	.0014	.....	.....	.....	.....	
122,750	25,000	.0213	.0058	.0061	.0023	.....	.....	.....	.....	
Alternate loads, 25,000 pounds per square inch each, applied four times by tension, five times by compression.										
122,750	25,000	.....	.....	.....	.....	.00116	.0029	.00038	.00068	
24,550	5,000	.00288	.0154	.0010	.0007	.....	.....	.....	.....	
49,100	10,000	.0077	.0035	.0018	.0008	.....	.....	.....	.....	
73,650	15,000	.0111	.0038	.0025	.0007	.....	.....	.....	.....	
98,200	20,000	.0159	.0048	.0040	.0015	.....	.....	.....	.....	
122,750	25,000	.0216	.0056	.0062	.0023	.....	.....	.....	.....	
24,550	5,000	.....	.....	.....	.....	.0033	.0123	.00054	.00008	
49,100	10,000	.....	.....	.....	.....	+	.0055	.00043	.00011	
73,650	15,000	.....	.....	.....	.....	.0041	.0089	.00030	.00013	
98,200	20,000	.....	.....	.....	.....	.0079	.0038	.00018	.00012	
122,750	25,000	.....	.....	.....	.....	.0115	.0036	.00033	.00015	
24,550	5,000	.....	.....	.....	.....	.0015	.0100	.00033	0	
49,100	10,000	.....	.....	.....	.....	.0040	+	.0004	.00001	
73,650	15,000	.....	.....	.....	.....	.0065	.0025	.00004	0	
98,200	20,000	.....	.....	.....	.....	.0090	.0026	.00004	0	
122,750	25,000	.....	.....	.....	.....	.0117	.0027	.00002	+.00002	
24,550	5,000	.00332	.0149	.0007	.00005	.....	.....	.....	.....	
49,100	10,000	.0070	.0038	.0014	.0007	.....	.....	.....	.....	
73,650	15,000	.0110	.0040	.0025	.0011	.....	.....	.....	.....	
98,200	20,000	.0159	.0049	.0041	.0016	.....	.....	.....	.....	
122,750	25,000	.0218	.0059	.0063	.0022	.....	.....	.....	.....	
24,550	5,000	.0093	.0125	.0063	0	.....	.....	.....	.....	
49,100	10,000	.0122	+	.0079	.0001	.....	.....	.....	.....	
73,650	15,000	.0151	+	.0084	0	.....	.....	.....	.....	
98,200	20,000	.0183	.0099	.0084	.0001	.....	.....	.....	.....	
122,750	25,000	.0221	.0058	.0093	+.0006	.....	.....	.....	.....	
122,750	25,000	.....	.....	.....	.....	.00116	.0087	.....	.....	









No. 5516—Continued.

Applied loads.		Under tensile stress.				Under compressive stress.				Remarks.
Total.	Per square inch.	Elongation per inch.		Permanent set per inch.		Compression per inch.		Permanent set per inch.		
		Total.	Successive.	Total.	Successive.	Total.	Successive.	Total.	Successive.	
<i>Pounds.</i>		<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
24,500	5,000	—, 01243	.00244	—, 01268	.00008	—, 01268	.00008	—, 01268	.00008	
48,100	10,000	—, 01296	.00037	—, 01256	.00012	—, 01256	.00012	—, 01256	.00012	
73,650	15,000	—, 01158	.00048	—, 01238	.00018	—, 01238	.00018	—, 01238	.00018	
98,200	20,000	—, 01095	.00063	—, 01204	.00034	—, 01204	.00034	—, 01204	.00034	
145,800	29,650	.....	.....	.....	.....	.....	.....	.....	.....	Tensile strength.

Fractured at the neck. Appearance, uniform granular.

No. 5758.

CAST IRON BAR.

Marks, OOB<sub>1</sub>.

Diameter, 3".

Sectional area, 7.068 square inches.

Tensile strength, 203,900 pounds = 28.840 pounds per square inch.

Fractured at root of thread, which was 3".65 diameter = 10.46 square inches area.

Tensile strength per square inch at root of thread 19,490 pounds.

Appearance of fracture, granular, mottled.

No. 5759.

CAST IRON BAR.

Marks, 11 M 6.

Diameter, 3".

Sectional area, 7.068 square inches.

Tensile strength, 205,700 pounds = 29,100 per square inch.

Fractured at the neck. Appearance, granular, mottled.

No. 5760.

CAST IRON BAR.

Marks, B<sup>11</sup><sub>4</sub>

Diameter, 3".

Sectional area, 7.068 square inches.

Gauged length, 10".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
7,068	1,000	0.	0.	0.	0.	
14,136	2,000	.00007	.00007	-----	-----	
21,204	3,000	.00012	.00005	-----	-----	
28,272	4,000	.00016	.00004	-----	-----	
35,340	5,000	.00022	.00006	.00002	.00002	
42,408	6,000	.00028	.00008	-----	-----	
49,476	7,000	.00033	.00005	-----	-----	
56,544	8,000	.00038	.00005	-----	-----	
63,612	9,000	.00043	.00005	-----	-----	
70,680	10,000	.00048	.00005	.00005	.00003	
77,748	11,000	.00054	.00006	-----	-----	
84,816	12,000	.00060	.00006	-----	-----	
91,884	13,000	.00068	.00008	-----	-----	
98,952	14,000	.00073	.00005	.00008	.00003	
106,020	15,000	.00081	.00008	-----	-----	
113,088	16,000	.00088	.00007	.00013	.00005	
120,156	17,000	.00095	.00007	-----	-----	
127,224	18,000	.00103	.00008	.00015	.00002	
134,292	19,000	.00113	.00010	-----	-----	
141,360	20,000	.00128	.00010	.00021	.00006	
148,428	21,000	.00133	.00010	-----	-----	
155,496	22,000	.00147	.00014	.00031	.00010	
162,564	23,000	.00161	.00014	-----	-----	
169,632	24,000	.00179	.00018	.00048	.00017	
176,700	25,000	.00200	.00021	.00062	.00014	
212,700	30,000	-----	-----	-----	-----	Tensile strength.

Fractured 1".4 from neck. Appearance, granular, mottled.

No. 5761.

## CAST IRON BAR.

Marks, 11 B 6.

Diameter, 3".

Sectional area, 7.068 square inches.

Gauged length, 10".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
7,068	1,000	0.	0.	0.	0.	
14,136	2,000	.00007	.00007	.....	.....	
21,204	3,000	.00012	.00005	.....	.....	
28,272	4,000	.00016	.00004	.....	.....	
35,340	5,000	.00022	.00006	.00001	.00001	
42,408	6,000	.00027	.00005	.....	.....	
49,476	7,000	.00033	.00006	.....	.....	
56,544	8,000	.00037	.00004	.....	.....	
63,612	9,000	.00043	.00006	.....	.....	
70,680	10,000	.00050	.00007	.00004	.00003	
77,748	11,000	.00055	.00005	.....	.....	
84,816	12,000	.00061	.00006	.....	.....	
91,884	13,000	.00067	.00006	.....	.....	
98,952	14,000	.00074	.00007	.....	.....	
106,020	15,000	.00080	.00006	.00007	.00003	
113,088	16,000	.00089	.00009	.00010	.00003	
120,156	17,000	.00096	.00007	.....	.....	
127,224	18,000	.00105	.00009	.00013	.00003	
134,292	19,000	.00114	.00009	.....	.....	
141,360	20,000	.00125	.00011	.00020	.00007	
148,428	21,000	.00135	.00010	.....	.....	
155,496	22,000	.00148	.00013	.00029	.00009	
162,564	23,000	.00164	.00016	.....	.....	
169,632	24,000	.00184	.00020	.00047	.00018	
176,700	25,000	.00201	.00020	.00059	.00012	
212,700	30,000	.....	.....	.....	.....	Tensile strength.

Fractured, ".9 from neck. Appearance, granular, mottled.

CAST IRON.

SAND CASTING.

No. 2770.

Original dimensions of specimen:

Length, 12".97.

Diameter, 3".

Sectional area, 7.069 square inches.

Gauged length, 10".

(See Report 1889, page 651, for earlier test of this specimen. Test resumed after a period of rest of four months.)

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Com- pression.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Permanent set when test was discontinued.
7.069	1,000	.....	.0769	
35,345	5,000	.0790	.....	
70,690	10,000	.0818	.....	
106,035	15,000	.0847	.....	
141,380	20,000	.0876	.....	
176,725	25,000	.0905	.....	
212,070	30,000	.0937	.....	
247,415	35,000	.0968	.....	
282,760	40,000	.0999	.....	
247,415	34,000	.0975	.....	
212,070	30,000	.0949	.....	
176,725	25,000	.0918	.....	
141,380	20,000	.0889	.....	
106,035	15,000	.0860	.....	
70,690	10,000	.0830	.....	
35,345	5,000	.0795	.0769	
70,690	10,000	.0817	.....	
106,035	15,000	.0848	.....	
141,380	20,000	.0877	.....	
106,035	15,000	.0850	.....	
70,690	10,000	.0822	.....	
35,345	5,000	.0793	.0769	
35,345	5,000	.0789	.....	
70,690	10,000	.0817	.....	
106,035	15,000	.0847	.....	
141,380	20,000	.0877	.....	
176,725	25,000	.0906	.....	
212,070	30,000	.0936	.....	
247,415	35,000	.0966	.....	
282,760	40,000	.0998	.....	
247,415	35,000	.0974	.....	
212,070	30,000	.0944	.....	
176,725	25,000	.0917	.....	
141,380	20,000	.0888	.....	
106,035	15,000	.0857	.....	
70,690	10,000	.0827	.....	
35,345	5,000	.0795	.0769	
282,760	40,000	.....	.0769	Repeated 100 times in one hour and a quarter.
7.069	1,000	.....	.0769	
35,345	5,000	.0790	.....	
70,690	10,000	.0819	.....	
106,035	15,000	.0848	.....	
141,380	20,000	.0878	.....	
176,725	25,000	.0907	.....	
212,070	30,000	.0936	.....	
247,415	35,000	.0966	.....	
282,760	40,000	.0996	.....	
247,415	35,000	.0970	.....	
212,070	30,000	.0943	.....	
176,725	25,000	.0916	.....	
106,035	15,000	.0857	.....	
70,690	10,000	.0825	.....	
35,345	5,000	.0794	.0769	
282,760	40,000	.0995	.....	
318,105	45,000	.1028	.....	
353,450	50,000	.1067	.....	
424,140	60,000	.1177	.....	

## No. 2770—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
388, 795	55, 000	.1100	.....	
353, 450	50, 000	.1134	.....	
318, 106	45, 000	.1106	.....	
282, 760	40, 000	.1080	.....	
247, 415	35, 000	.1050	.....	
212, 070	30, 000	.1020	.....	
176, 725	25, 000	.0989	.....	
141, 380	20, 000	.0956	.....	
106, 035	15, 000	.0920	.....	
70, 690	10, 000	.0884	.....	
35, 345	5, 000	.0842	.0806	
35, 345	5, 000	.0830	.....	
70, 690	10, 000	.0858	.....	
106, 035	15, 000	.0887	.....	
141, 380	20, 000	.0917	.....	
176, 725	25, 000	.0946	.....	
212, 070	30, 000	.0977	.....	
247, 415	35, 000	.1007	.....	
282, 760	40, 000	.1041	.....	
318, 106	45, 000	.1073	.....	
353, 450	50, 000	.1107	.....	
388, 795	55, 000	.1144	.....	
424, 140	60, 000	.1195	.....	
388, 795	55, 000	.1173	.....	
353, 450	50, 000	.1146	.....	
318, 105	45, 000	.1110	.....	
282, 760	40, 000	.1091	.....	
247, 415	35, 000	.1063	.....	
212, 070	30, 000	.1033	.....	
176, 725	25, 000	.1000	.....	
141, 380	20, 000	.0970	.....	
106, 035	15, 000	.0935	.....	
70, 690	10, 000	.0899	.....	
35, 345	5, 000	.0858	.0820	
35, 345	5, 000	.0843	.....	
70, 690	10, 000	.0873	.....	
106, 035	15, 000	.0903	.....	
141, 380	20, 000	.0931	.....	
176, 725	25, 000	.0962	.....	
212, 070	30, 000	.0991	.....	
247, 415	35, 000	.1024	.....	
282, 760	40, 000	.1055	.....	
247, 415	35, 000	.1028	.....	
212, 070	30, 000	.1000	.....	
176, 725	25, 000	.0973	.....	
141, 380	20, 000	.0944	.....	
106, 035	15, 000	.0915	.....	
70, 690	10, 000	.0883	.....	
35, 345	5, 000	.0850	.0820	

Total length, 12".870.

Specimen heated by being placed on hot plates till its length was 12".938 ∴ expansion = ".068.

Estimated temperature, 1,222° Fahr.

Cooled in the open air.

The apparent length of the bar after above annealing and cooling was 12".872.

The recovery of ".002 here shown received confirmation by the micrometer used for measuring the compression within the gauged length, which appeared to show a recovery of ".0032.

The change in condition of the measured surfaces which occurred during the annealing process prevented a closer determination of the effect of annealing on the length of the bar, but from these measurements it is probable that annealing produced a permanent elongation of the bar.



No. 2770—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
7,069	1,000	.....	.0788	
35,345	5,000	.....	.0807	
70,690	10,000	.....	.0837	.0788
106,035	15,000	.....	.0867	
141,380	20,000	.....	.0898	.0789
176,725	25,000	.....	.0927	
212,070	30,000	.....	.0957	.0790
247,415	35,000	.....	.0987	
282,760	40,000	.....	.1018	
247,415	35,000	.....	.0992	
212,070	30,000	.....	.0964	
176,725	25,000	.....	.0938	
141,380	20,000	.....	.0907	
106,035	15,000	.....	.0878	
70,690	10,000	.....	.0847	
35,345	5,000	.....	.0815	.0792
35,345	5,000	.....	.0812	
70,690	10,000	.....	.0842	
106,035	15,000	.....	.0870	
141,380	20,000	.....	.0900	
176,725	25,000	.....	.0930	
212,070	30,000	.....	.0959	
247,415	35,000	.....	.0988	
141,380	20,000	.....	.0907	.0792
282,760	40,000	.....	.1017	
353,450	50,000	.....	.1082	.0793
424,140	60,000	.....	.1106	.0803
459,485	65,000	.....	.1230	.0831
494,830	70,000	.....	.1695	
459,485	65,000	.....	.1677	
424,140	60,000	.....	.1650	
388,795	55,000	.....	.1624	
353,450	50,000	.....	.1597	
318,105	45,000	.....	.1569	
282,760	40,000	.....	.1540	
247,415	35,000	.....	.1509	
212,070	30,000	.....	.1478	
176,725	25,000	.....	.1445	
141,380	20,000	.....	.1409	
106,035	15,000	.....	.1373	
70,690	10,000	.....	.1300	
35,345	5,000	.....	.1285	.1241
35,345	5,000	.....	.1259	
70,690	10,000	.....	.1289	
106,035	15,000	.....	.1320	
141,380	20,000	.....	.1348	
176,725	25,000	.....	.1380	
212,070	30,000	.....	.1400	
247,415	35,000	.....	.1440	
282,760	40,000	.....	.1473	
247,415	35,000	.....	.1447	
212,070	30,000	.....	.1420	
176,725	25,000	.....	.1392	
141,380	20,000	.....	.1362	
106,035	15,000	.....	.1332	
70,690	10,000	.....	.1300	
35,345	5,000	.....	.1266	.1238
565,520	80,000	.....	.....	
530,175	75,000	.....	.2703	
494,830	70,000	.....	.2679	
459,485	65,000	.....	.2652	
424,140	60,000	.....	.2625	
388,795	55,000	.....	.2598	
353,450	50,000	.....	.2568	
318,105	45,000	.....	.2540	
282,760	40,000	.....	.2507	
247,415	35,000	.....	.2475	
212,070	30,000	.....	.2440	
176,725	25,000	.....	.2405	
141,380	20,000	.....	.2366	
106,035	15,000	.....	.2323	
70,690	10,000	.....	.2279	
35,345	5,000	.....	.2227	.2173
.....	.....	.....	.2160	
35,345	5,000	.....	.2100	
70,690	10,000	.....	.2220	
106,035	15,000	.....	.2250	

Set after 15 minutes' rest, ".1235.

After resting 1 hour.

## No. 2770—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
141, 380	20, 000	.2280	.....	
176, 725	25, 000	.2310	.....	
212, 070	30, 000	.2342	.....	
247, 415	35, 000	.2373	.....	
282, 760	40, 000	.2405	.....	
247, 415	35, 000	.2379	.....	
212, 070	30, 000	.2352	.....	
176, 725	25, 000	.2322	.....	
141, 380	20, 000	.2293	.....	
106, 035	15, 000	.2262	.....	
70, 690	10, 000	.2232	.....	
35, 345	5, 000	.2199	.2164	
600, 865	85, 000	.....	.....	Specimen bent. Assumes an ogree shape.
530, 175	75, 000	.3398	.....	
494, 830	70, 000	.3374	.....	
459, 485	65, 000	.3345	.....	
424, 140	60, 000	.3316	.....	
388, 795	55, 000	.3288	.....	
353, 450	50, 000	.3258	.....	
318, 105	45, 000	.3227	.....	
282, 760	40, 000	.3195	.....	
247, 415	35, 000	.3160	.....	
212, 070	30, 000	.3127	.....	
176, 725	25, 000	.3088	.....	
141, 380	20, 000	.3045	.....	
106, 035	15, 000	.3006	.....	
70, 690	10, 000	.2955	.....	
35, 345	5, 000	.2900	.2849	
35, 345	5, 000	.2868	.....	
70, 690	10, 000	.2898	.....	
106, 035	15, 000	.2930	.....	
141, 380	20, 000	.2958	.....	
176, 725	25, 000	.2987	.....	
212, 070	30, 000	.3019	.....	
247, 415	35, 000	.3050	.....	
282, 760	40, 000	.3080	.....	
247, 415	35, 000	.3058	.....	
212, 070	30, 000	.3028	.....	
176, 725	25, 000	.3003	.....	
141, 380	20, 000	.2975	.....	
106, 035	15, 000	.2943	.....	
70, 690	10, 000	.2911	.....	
35, 345	5, 000	.2875	.2844	
636, 210	90, 000	.....	.....	Maximum load applied.

Metal began to disintegrate at spongy spot near the end of the specimen.

Cracks oblique to the axis of the specimen developed on part of the cylindrical surface.



CAST IRON FROM WATERTOWN ARSENAL FOUNDRY, AND PIG IRONS.

No. of test.	Description.	Marks.	Chemical composition.										Tensile strength per square inch.	Fracture.	Remarks.	
			Carbon.			Manga- nese.	Silicon.	Sul- phur.	Phos- phorus.	Copper.	Total.					
			Graph- itic.	Com- bined.	Graph- itic.						Com- bined.					
5003	12-inch mortar shell	12 M SH H <sub>2</sub> B L <sub>1</sub>												Pounds.	Granular, mottled	
5004	do	12 M SH H <sub>2</sub> B L <sub>1</sub>												29,070	Granular	
5005	do	12 M SH H <sub>2</sub> B L <sub>1</sub>												26,000	Granular, mottled	
5007	do	12 M SH H <sub>2</sub> B L <sub>1</sub>	8.185	2.806	0.389	0.415	0.905	0.120	0.491	0.004				26,380	Granular, mottled	
5008	do	12 M SH H <sub>2</sub> B L <sub>1</sub>												30,350	do	
5011	do	12 M SH H <sub>2</sub> B L <sub>1</sub>												29,580	do	
5009	do	12 M SH H <sub>2</sub> B L <sub>1</sub>												29,980	Granular	Cast from air furnace.
5013	do													24,230	Fine granular, slightly mottled.	Cast from air furnace.
5019	Chassis for 8" B. L. rifle carriage.													23,660	Fine granular	From cupola furnace.
5020	do													29,370	Granular, mottled	From air furnace.
														25,920	Very fine granular. Grey, with a small hard spots.	From air furnace.
PIG IRONS.																
4888	Muirkirk pig		3.199	2.	1.199	0.770	0.940	0.115	0.475	0.000				28,040	Granular	
5018	do	Pig No. 2												33,190	Fine granular	
4390	do	Lone Star	3.239	3.141	0.098	0.120	3.335	0.080	0.277	None.				34,450	Granular, varying from coarse to fine.	
5006	Lone star pig iron.													12,490	Granular, varying from coarse to fine.	
5012	Katahdin pig.	Katahdin pig	3.379	2.980	0.369	1.195	1.000	0.025	0.624	None.				25,040	Fine granular	
5014	From Boiling Springs Iron Company.	II												17,380	do	
5015	do	III	3.378	2.917	0.481	1.000	1.500	0.025	0.498	None.				18,990	Fine granular of vary- ing fineness.	
5016	do	IIII	3.002	2.410	0.502	0.415	0.970	0.040	0.740	None.				24,660	Fine granular, 50 per cent of surface spongy.	
5017	do	IIII½	3.016	2.893	0.123	0.384	1.310	0.035	1.030	None.				20,010	Fine granular, mottled.	

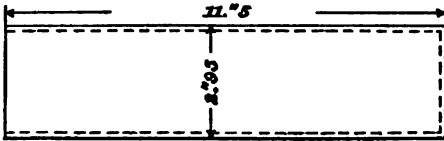
COMPRESSION TESTS OF CHILLED CAST IRON.

For the original tests of these specimens, see Report of tests 1889, pages 653, 656.

The interior unchilled metal was bored out, leaving the hardened shell to be tested in the present instance.

No. 5771.

ORIGINAL TEST No. 2778.



Average diameter of hole, 2".57.  
 Sectional area, 1.65 square inches.  
 Gauged length, 9.94 square inches.

Applied loads.		In gauged lengths.		Remarks.
Total.	Per square inch.	Com-pression.	Set.	
Pounds.	Pounds.	Inch.	Inch.	
1,650	1,000	0.	0.	Initial load.  E=23,660,000, between 5,000 and 40,000 pounds per square inch.  Snapping sound.
8,250	5,000	.0022	.0001	
16,500	10,000	.0044	.0002	
24,750	15,000	.0065	.0003	
33,000	20,000	.0087	.0004	
41,250	25,000	.0110	.0005	
49,500	30,000	.0132	.0006	
57,750	35,000	.0153	.0006	
66,000	40,000	.0175	.0007	
74,250	45,000	.0197	.0008	
82,500	50,000	.0220	.0009	
90,750	55,000	.0244	.0012	
99,000	60,000	.0268	.0013	
107,250	65,000	.0291	.0014	
115,500	70,000	.0314	.0015	
123,750	75,000	.0339	.0016	
132,000	80,000	.0363	.0019	

Test discontinued, removed from the testing machine, and heated bright red, then cooled in the open air.

After heating as above, the metal which was chilled was softened and could be filed easily.

Test resumed.

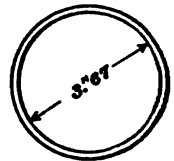
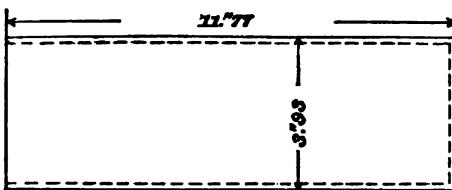
No. 5771—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
1,650	1,000	0.	0.	Micrometer reset at zero.
8,250	5,000	.0010	0.	
16,500	10,000	.0029	.0001	
24,750	15,000	.0052	.0053	
33,000	20,000	.0076	.0004	
41,250	25,000	.0100	.0008	
49,500	30,000	.0127	.0008	
57,750	35,000	.0152	.0010	
66,000	40,000	.0179	.0013	
74,250	45,000	.0210	.0018	
82,500	50,000	.0250	.0052	
90,750	55,000	.0308	.0080	
99,000	60,000	.0408	.0130	
8,250	5,000	.0148	.....	E = 22,800,000, between 5,000 and 40,000 pounds per square inch.
16,500	10,000	.0169	.....	
24,750	15,000	.0191	.....	
33,000	20,000	.0214	.....	
41,250	25,000	.0236	.0130	
152,300	92,300	.....	.....	

Burst into small fragments.

No. 5772.

ORIGINAL TEST NO. 2896.



Diameter of hole, 3'' .67.

Sectional area, 1.55 square inches.

Gauged length, 10''.

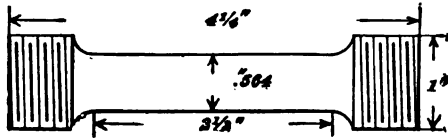
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
1,550	1,000	0.	0.	Initial load.
7,750	5,000	.0019	0.	
15,500	10,000	.0040	0.	
23,250	15,000	.0080	0.	
31,000	20,000	.0080	.0001	
38,750	25,000	.0097	.0001	
46,500	30,000	.0121	.0001	E = 24,820,000, between 5,000 and 40,000 pounds per square inch.
54,250	35,000	.0142	.0002	
62,000	40,000	.0183	.0003	
69,750	45,000	.0184	.0004	
77,500	50,000	.0206	.0005	
85,250	55,000	.0228	.0008	
93,000	60,000	.0240	.0009	
100,750	65,000	.0271	.0011	
108,500	70,000	.0293	.0013	
116,250	75,000	.0317	.0015	
124,000	80,000	.0342	.0019	
190,900	123,160	.....	.....	

Burst into small fragments.

From the appearance of the fragments the metal was chilled to a depth of  $.07 \pm$ ; hence in this specimen about seven-thirteenths of the thickness of the walls was hard chilled iron, the remaining part being unchilled metal.

## TWO SPECIMENS OF STEEL FROM SPRINGFIELD ARMORY.

No. 5545.



Marks, I W.

Sectional area, .25 square inch.

Elastic limit, 11,200 pounds=44,800 pounds per square inch.

Tensile strength, 21,680 pounds=86,720 pounds per square inch.

Elongation in 2 inches ".53=26.5 per cent.

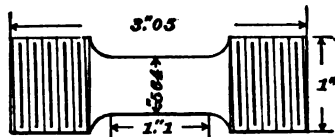
Elongation of inch sections, ".31\*, ".22.

Diameter at fracture, ".43. Area, .145 square inch.

Contraction of area, 41.9 per cent.

Appearance of fracture, silky. Cup shaped.

No. 5546.



Marks, F C S.

Sectional area, .25 square inch.

Elastic limit, 17,800 pounds=71,200 pounds per square inch.

Tensile strength, 27,120 pounds=108,480 pounds per square inch.

Elongation in 1 inch, ".22.

Diameter at fracture, ".49. Area, .189 square inch.

Contraction of area, 24.6 per cent.

Appearance of fracture, fine granular; dull eccentric spot.





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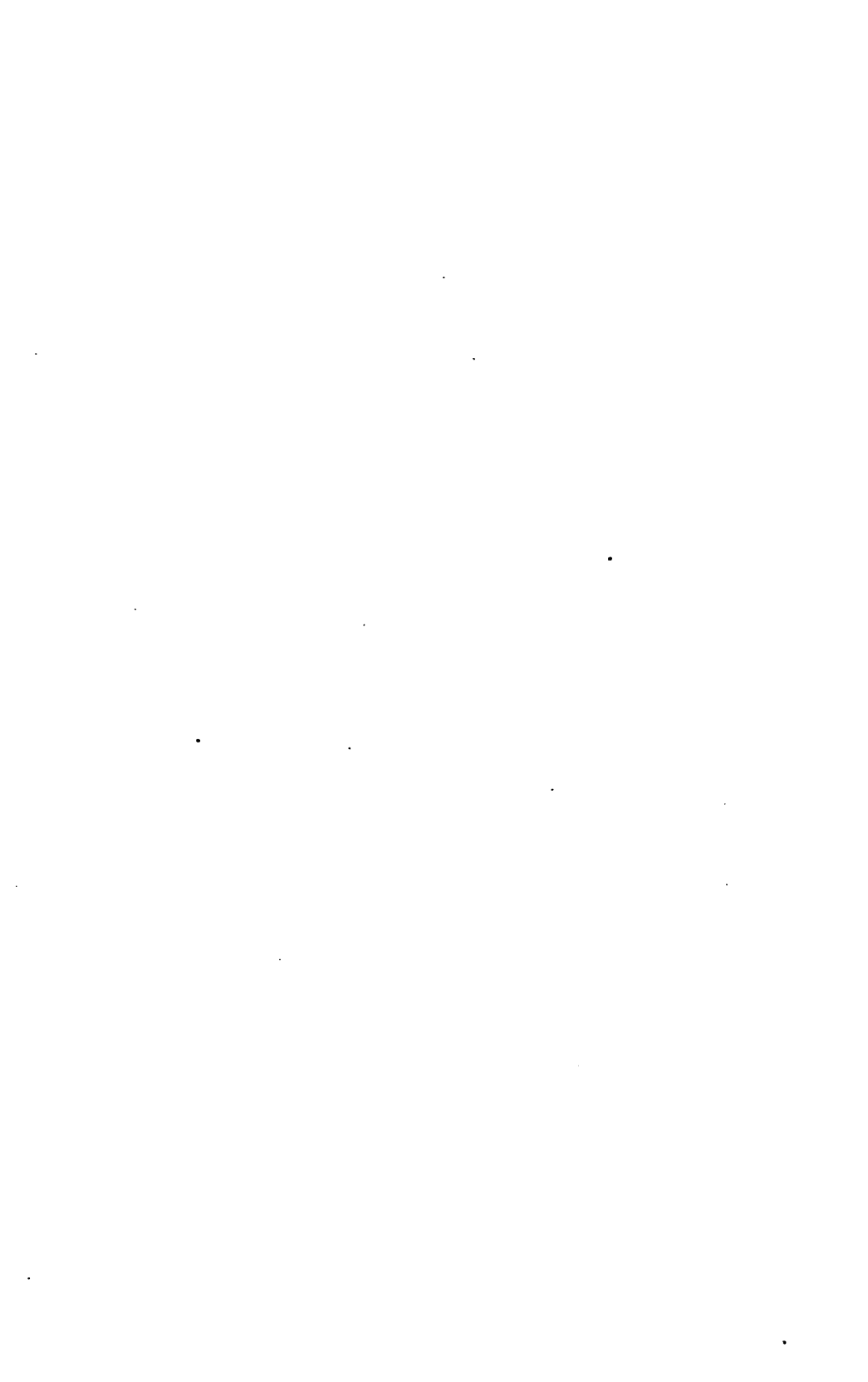
# RAILWAY AXLES.

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H. Ex. 43—30

465



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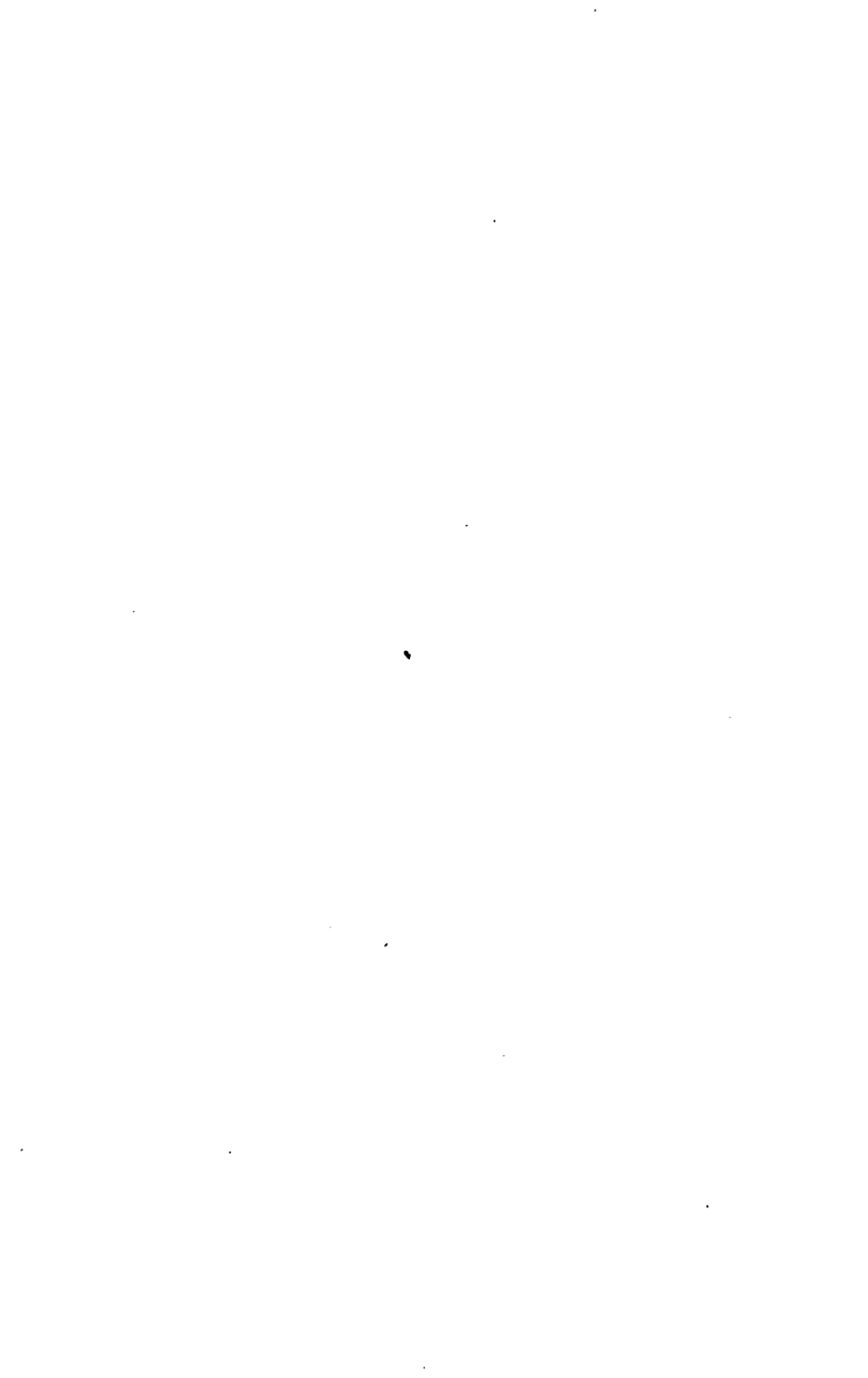
# RAILWAY AXLES.

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H. Ex. 43—30

465

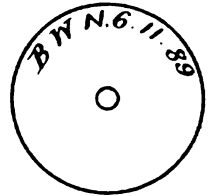
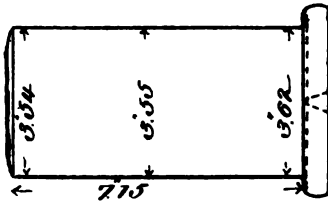




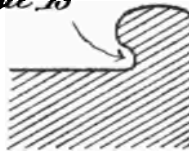
*Wrought-Iron Railway Axle.*

*Fractured Journal.*

*Fractured  
end*



*The button was under-wore about .15*



*Enlarged view of button.*

## RAILWAY AXLES.

Specimens Nos. 4729 and 4730 were from the fractured journal of a wrought axle.

The axle was from a palace-car four-wheel truck, and had been in service about three years; the exact time is not known.

The journal had a progressive annular fracture which had reduced the solid metal to 2".1 diameter at the time of final rupture.

Specimens Nos. 4731 and 4732 were from a section of a new wrought-iron axle.

The hammered specimens were metal drawn down from new axles.

### TWO LONGITUDINAL SPECIMENS FROM FRACTURED JOURNAL.

No. 4729.

Diameter ".564.

Sectional area, .25 square inch.

Gauged length, 4".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
250	1,000	0.	0.	Initial load.
1,250	5,000	.0008	-----	
2,500	10,000	.0011	-----	
5,000	20,000	.0025	0.	Elastic limit.
5,250	21,000	.0031	-----	
5,500	22,000	.0039	-----	
5,750	23,000	.0184	-----	
6,000	24,000	.0255	-----	
6,250	25,000	.0300	-----	
6,500	26,000	.0405	-----	
6,750	27,000	.0480	-----	
7,000	28,000	.0580	-----	
7,250	29,000	.0650	-----	
7,500	30,000	.0623	-----	
7,750	31,000	.0891	-----	
8,000	32,000	.1020	-----	
8,250	33,000	.1150	-----	
8,500	34,000	.1520	-----	
8,750	35,000	.17	-----	
9,000	36,000	.19	-----	
9,250	37,000	.21	-----	
9,500	38,000	.23	-----	
9,750	39,000	.26	-----	
10,000	40,000	.29	-----	
10,250	41,000	.32	-----	
10,500	42,000	.38	-----	
10,750	43,000	.40	-----	
11,000	44,000	.48	-----	
11,480	45,920	-----	-----	Tensile strength.
0	0	1.00	-----	=25.0 per cent.

Elongation of inch sections: ".44, ".21, ".19, ".16.

Diameter at fracture, ".43. Area, .145 square inch.

Contraction of area, 41.9 per cent.

Fractured ".9 from neck. Appearance, fibrous.

No. 4730.

Diameter, ".564.

Sectional area, .25 square inch.

Gauged length, 4".

Applied loads.		In gauged length.		Remarks.
Total	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inches.</i>	<i>Inch.</i>	Initial load.
250	1,000	0.	0.	
1,250	5,000	.0004	.....	Elastic limit.
2,500	10,000	.0014	.....	
4,500	18,000	.0028	.....	
4,750	19,000	.0029	.....	
5,000	20,000	.0033	.0010	
5,250	21,000	.0050	.....	
5,500	22,000	.0080	.....	
5,750	23,000	.0229	.....	
6,000	24,000	.0810	.....	
6,250	25,000	.0300	.....	
6,500	26,000	.0433	.....	
6,750	27,000	.0562	.....	
7,000	28,000	.0688	.....	
7,250	29,000	.0745	.....	
7,500	30,000	.0830	.....	
7,750	31,000	.0880	.....	
8,000	32,000	.1120	.....	
8,250	33,000	.1250	.....	
8,500	34,000	.1430	.....	
8,750	35,000	.1580	.....	
9,000	36,000	.1830	.....	
9,250	37,000	.2000	.....	
9,500	38,000	.2250	.....	
9,750	39,000	.2500	.....	
10,000	40,000	.2850	.....	
10,250	41,000	.3160	.....	
10,500	42,000	.39	.....	
10,750	43,000	.45	.....	
11,000	44,000	.56	.....	
11,250	45,000	.74	.....	
11,280	45,120	.....	.....	Tensile strength.
0	0	1.07	.....	= 26.8 per cent.

Elongation of inch sections, ".20, ".27, ".42\*, ".18.

Diameter at fracture, ".42. Area, .139 square inch.

Contraction of area, 44.4 per cent.

Fractured 2/3 from neck. Appearance, fibrous.



TWO SPECIMENS FROM A SECTION OF AXLE 16" LONG BY 5½"  
DIAMETER.

No. 473L.

Diameter, 1".129.

Sectional area, 1 square inch.

Gauged length, 10".

Applied loads.		In gauged length.		Remarks.	
Total.	Per square inch.	Elongation.	Set.		
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inches.</i>	<i>Inch.</i>	Initial load.	
1,000	1,000	0.	0.		
5,000	5,000	.0014	0.		
10,000	10,000	.0032	.....		
15,000	15,000	.0050	.....		
18,000	18,000	.0062	.....		
17,000	17,000	.0057	.....		
18,000	18,000	.0060	.....		
19,000	19,000	.0065	.....		
20,000	20,000	.0070	.0002		Elastic limit.
21,000	21,000	.0078	.....		
22,000	22,000	.0088	.....		
23,000	23,000	.0131	.....		
24,000	24,000	.0250	.....		
25,000	25,000	.0431	.0340		
26,000	26,000	.0631	.....		
27,000	27,000	.0720	.....		
28,000	28,000	.0950	.....		
29,000	29,000	.1280	.....		
30,000	30,000	.1550	.....		
31,000	31,000	.1830	.....		
32,000	32,000	.2100	.....		
33,000	33,000	.2320	.....		
34,000	34,000	.2760	.....		
35,000	35,000	.32	.....		
36,000	36,000	.36	.....		
37,000	37,000	.40	.....		
38,000	38,000	.46	.....		
39,000	39,000	.51	.....		
40,000	40,000	.58	.....		
42,000	42,000	.59	.....		Rested 1 hour without load.
43,000	43,000	.61	.....		
44,000	44,000	.88	.....		
45,000	45,000	1.03	.....		
46,000	46,000	1.26	.....		Tensile strength.
0	0	1.34	.....		= 13.4 per cent.

Elongation of inch sections: ".12, ".29, \* ".11, ".11, ".12, ".11, ".10, ".12, ".14, ".12.

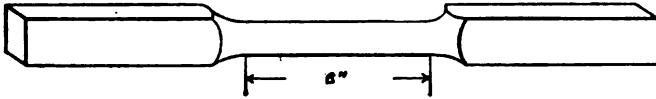
Diameter at fracture, ".1. Area, ".785 square inch.

Contraction of area, 21.5 per cent.

Fractured 1"5 from neck. Appearance, dull fibrous, slightly granular. Opened cracks along surface of the stem.



## HAMMERED SPECIMENS.



No. 5780.

**Mark, 1.**

Specimen drawn down from a new axle made of horseshoe iron.

Diameter, 1".017.

Sectional area, .812 square inch.

Elastic limit, 21,300 pounds=26,230 pounds per square inch.

Tensile strength, 40,860 pounds=50,320 pounds per square inch.

Elongation in 6 inches, 1".51=25.1 per cent.

Elongation of inch sections, ".18, ".30, ".49\*, ".20, ".17, ".17.

Diameter at fracture, ".76. Area, .454 square inch.

Contraction of area, 44.1 per cent.

Appearance of fracture, fibrous.

No. 5781.

**Marks, 11.**

Specimen drawn down from a new axle made of scrap iron.

Diameter, 1".019.

Sectional area, .815 square inch.

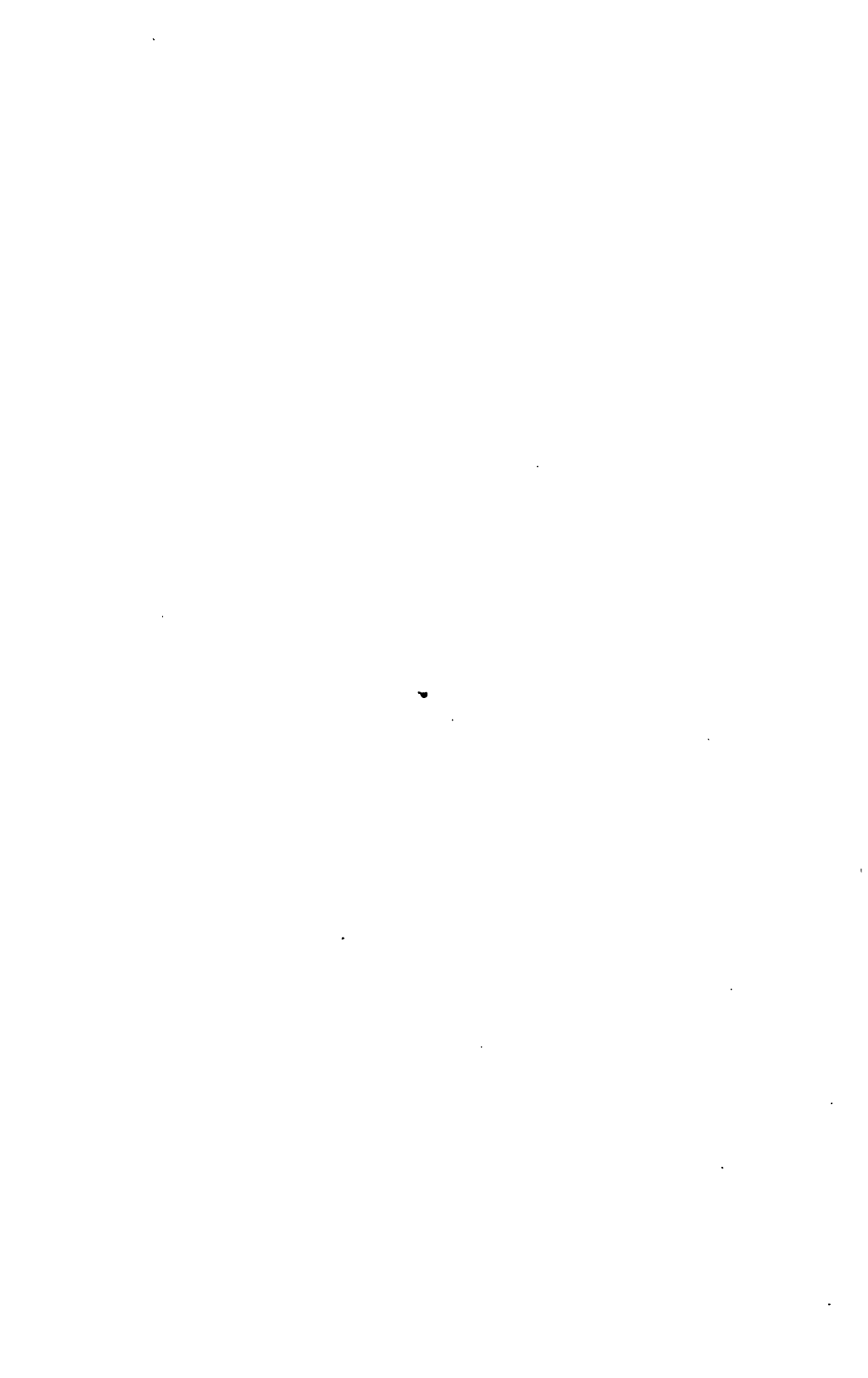
Elastic limit, 25,200 pounds=30,920 pounds per square inch.

Tensile strength, 42,700 pounds=52,390 pounds per square inch.

Elongation in 6 inches, 1".48=24.7 per cent.

Elongation of inch sections, ".30\*, ".35\*, ".16, ".21, ".28, ".18.

Appearance of fracture, fibrous.



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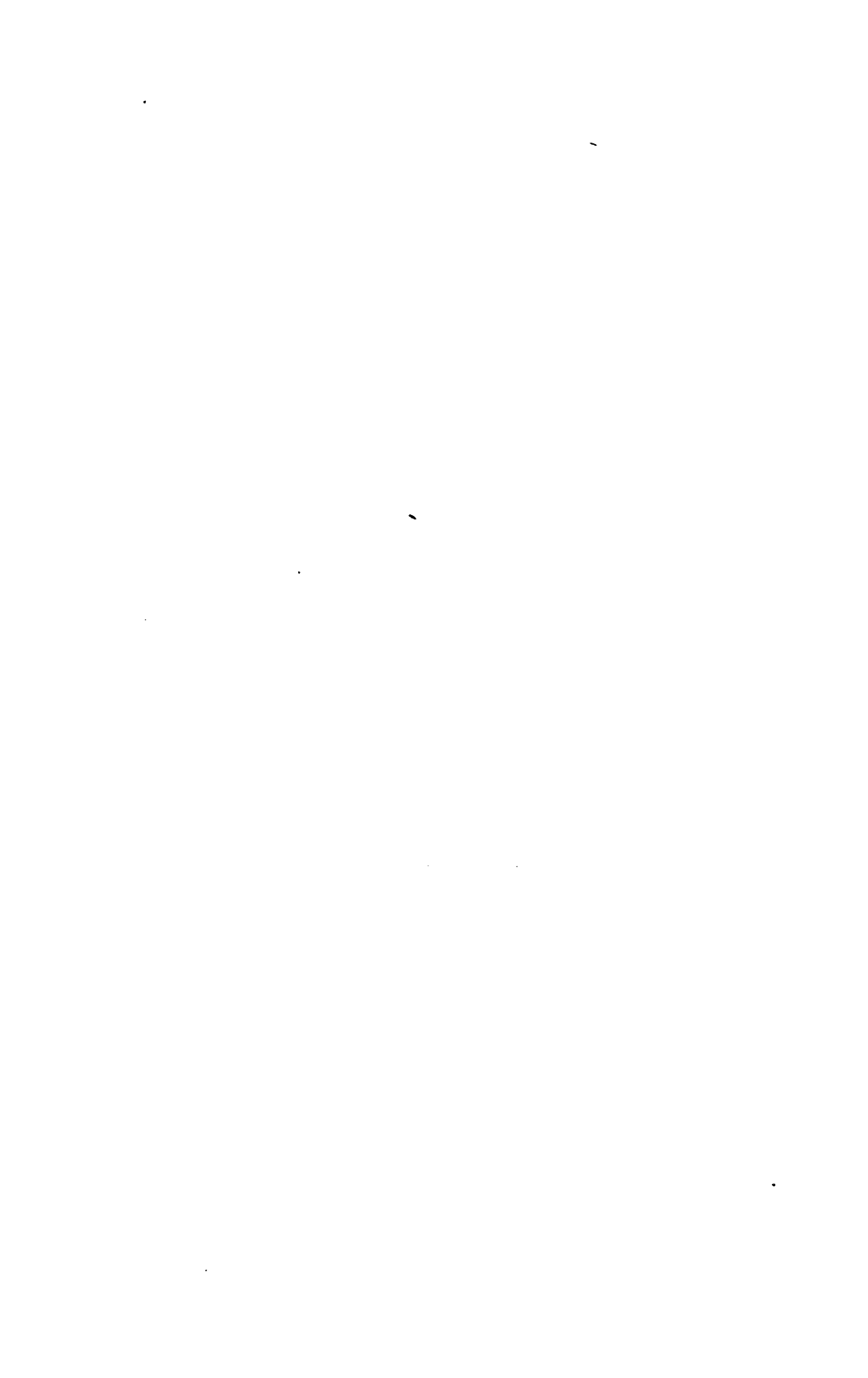
**RAILWAY DRIVING WHEEL TIRES.**

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**SPECIMENS FROM SECTIONS OF OLD WHEELS.**

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The brands of the tires and their cross-section dimensions were as follows:

Number of tire.	Brand.	Dimensions.	
		Width.	Thickness.
1	F. Krupp, 1871, P. VII, U. S. ....	<i>Inches.</i> 5½	<i>Inches.</i> 1.47
2	Vickers .....	5½	1.75
3	Nashua Iron and Steel Co. Cast Steel 1876.....	5½	1.8
4	Standard .....	5½	1.65
5	Midvale S. Co. # 24607.....	5½	1.63
6	Standard.....	6½	3

Nos. 1 to 5, inclusive, were old flanged tires; the thickness here recorded is the minimum to which they have been reduced in service.

No. 6 was a section of a new "blind" tire. Its name had apparently been stamped on recently, not being the original brand mark.

The specimens were taken out in a crosswise direction, and came from the middle of the thickness at the tread.

*CHEMICAL COMPOSITION OF SECTIONS FROM RAILWAY DRIVING WHEEL TIRES.*

Tension test number.	Mark.	Carbon.			Manganese.	Silicon.	Sulphur.	Phosphorus.	Copper.
		Total.	Graphitic.	Combined.					
4628	1	0.505	0.028	0.477	0.330	0.329	0.020	0.091	0.239
4629	2	0.450	0.020	0.430	0.300	0.142	0.014	0.058	0.041
4630	3	0.472	0.017	0.455	0.376	0.029	0.019	0.059	0.025
4631	4	0.575	0.025	0.550	0.406	0.283	0.062	0.071	0.045
4632	5	0.583	0.020	0.543	0.360	0.162	0.044	0.106	0.026
4633	6	0.604	0.024	0.580	0.560	0.145	0.051	0.063	0.027

No. 4628.

Marks, 1.

Diameter, ".564.

Sectional area, .25 square inch.

Gauged length, 3".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
250	1,000	0.	0.	
1,250	5,000	.0004	0.	Elastic limit.
2,500	10,000	.0010	-----	
5,000	20,000	.0021	-----	
7,500	30,000	.0032	0.	
10,000	40,000	.0042	0.	
11,250	45,000	.0047	-----	
11,500	46,000	.0048	-----	
11,750	47,000	.0049	-----	
12,000	48,000	.0051	-----	
12,250	49,000	.0052	-----	
12,500	50,000	.0055	.0012	
12,750	51,000	.0070	-----	
13,000	52,000	.0078	-----	
13,250	53,000	.0083	-----	
13,500	54,000	.0099	-----	
13,750	55,000	.0110	-----	
14,000	56,000	.0130	-----	
14,500	58,000	.0165	-----	
15,000	60,000	.0200	-----	
15,500	62,000	.0230	-----	
16,000	64,000	.0270	-----	
16,500	66,000	.0302	-----	
17,000	68,000	.0330	-----	
17,500	70,000	.0375	-----	
18,500	74,000	.05	-----	
19,500	78,000	.06	-----	
20,500	82,000	.07	-----	
21,500	86,000	.08	-----	
22,500	90,000	.09	-----	
23,500	94,000	.10	-----	
24,500	98,000	.11	-----	
25,500	102,000	.15	-----	
26,500	106,000	.18	-----	
27,420	109,680	-----	-----	Tensile strength. = 9.3 per cent.
0	0	.28	-----	

Elongation of inch sections: ".16", ".07", ".05.

Diameter at fracture, ".52. Area, .2124 square inch.

Contraction of area, 15 per cent.

Fractured  $\frac{3}{4}$ " from neck. Appearance, granular.



No. 4629.

Marks, 2.

Diameter, ".564.

Sectional area, .25 square inch.

Gauged length, 3".

Applied loads.		In gauged length.		Remarks.	
Total.	Per square inch.	Elongation.	Set.		
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>		
250	1,000	0.	0.	Initial load.	
1,250	5,000	.0003	0.		
2,500	10,000	.0010	0.		
5,000	20,000	.0020	0.		
7,500	30,000	.0029	0.		
10,000	40,000	.0040	0.		
10,250	41,000	.0041	0.		Elastic limit.
10,500	42,000	.0042	0.		
10,750	43,000	.0135	0.		
11,000	44,000	.0180	0.		
11,250	45,000	.0240	0.		
11,500	46,000	.0280	0.		
11,750	47,000	.0300	0.		
12,000	48,000	.0330	0.		
12,250	49,000	.0349	0.		
12,500	50,000	.0370	0.		
12,000	52,000	.0425	0.		
13,500	54,000	.0480	0.		
14,000	56,000	.0545	0.		
14,500	58,000	.0603	0.		
15,000	60,000	.0670	0.		
15,500	62,000	.0740	0.		
16,000	64,000	.0820	0.		
16,500	66,000	.0900	0.		
17,000	68,000	.0980	0.		
17,500	70,000	.1100	.1000		
18,500	74,000	.13	0.		
19,500	78,000	.17	0.		
20,500	82,000	.21	0.		
21,500	86,000	.23	0.		
22,240	88,960	0.	0.	Tensile strength. = 29.7 per cent.	
0	0	.62	0.		

Elongation of inch sections: ".29,\* ".17, ".15.

Diameter at fracture, ".46. Area, .1662 square inch.

Contraction of area, 33.5 per cent.

Fractured 1".10 from neck. Appearance, granular, silky center.

No. 4630.

Marks, 3.

Diameter, ".564.

Sectional area, .25 square inch.

Gauged length, 3".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
250	1,000	0.	0.	Initial load.
1,250	5,000	.0004	0.	
2,500	10,000	.0010	-----	Elastic limit.
5,000	20,000	.0020	-----	
7,500	30,000	.0030	.0001	
10,000	40,000	.0041	.0002	
10,250	41,000	.0042	-----	
10,500	42,000	.0044	-----	
10,750	43,000	.0052	-----	
11,000	44,000	.0085	-----	
11,250	45,000	.0094	-----	
11,500	46,000	.0110	-----	
11,750	47,000	.0129	-----	
12,000	48,000	.0145	-----	
12,250	49,000	.0162	-----	
12,500	50,000	.0179	.0121	
12,750	51,000	.0199	-----	
13,000	52,000	.0210	-----	
13,500	54,000	.0250	-----	
14,000	56,000	.0298	-----	
14,450	57,800	-----	-----	Tensile strength.
0	0	.04	-----	= 1.3 per cent.

Elongation of inch sections: ".01, ".02\*, ".01.

Contraction of area inappreciable.

Fractured 1".3 from neck. Appearance granular, with belt of flaky metal across middle of surface.

No. 4631.

Marks, 4.

Diameter, ".564.

Sectional area, .25 square inch.

Gauged length, 3".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
250	1,000	0.	0.	
1,250	5,000	.0004	0.	Elastic limit.
2,500	10,000	.0010	-----	
5,000	20,000	.0019	-----	
7,500	30,000	.0030	0.	
10,000	40,000	.0040	0.	
11,250	45,000	.0046	-----	
12,500	50,000	.0053	.0001	
12,750	51,000	.0055	-----	
13,000	52,000	.0057	-----	
13,250	53,000	.0059	-----	
13,500	54,000	.0060	-----	
13,750	55,000	.0062	.0008	
14,000	56,000	.0067	-----	
14,250	57,000	.0071	-----	
14,500	58,000	.0077	-----	
14,750	59,000	.0083	-----	
15,000	60,000	.0092	-----	
15,500	62,000	.0116	-----	
16,000	64,000	.0128	-----	
16,500	66,000	.0154	-----	
17,000	68,000	.0184	-----	
17,500	70,000	.0219	-----	
18,000	72,000	.0239	-----	
18,500	74,000	.0267	-----	
19,000	76,000	.0300	-----	
19,500	78,000	.0333	-----	
20,000	80,000	.0368	-----	
21,000	84,000	.05	-----	
22,000	88,000	.06	-----	
23,000	92,000	.07	-----	
24,000	96,000	.075	-----	
25,000	100,000	.08	-----	
26,000	104,000	.09	-----	
27,000	108,000	.11	-----	
28,000	112,000	.13	-----	
28,560	114,240	-----	-----	Tensile strength.
0	0	.14	-----	= 4.7 per cent.

Elongation of inch sections: ".97\*, ".04, ".03.

Diameter at fracture, ".55. Area, .2376 square inch.

Contraction of area, 4.8 per cent.

Fractured ".75 from neck. Appearance, medium fine granular, flaky.

No. 4632.

Marks, 5.

Diameter, ".564.

Sectional area, .25 square inch.

Gauged length, 3".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
250	1,000	0.	0.	Initial load.
1,250	5,000	.0003	0.	
2,500	10,000	.0009	0.	
5,000	20,000	.0019	0.	
7,500	30,000	.0029	— .0001	
10,000	40,000	.0040	— .0001	
11,250	45,000	.0048	0.	Elastic limit.
11,500	46,000	.0052		
11,750	47,000	.0052		
12,000	48,000	.0050		
12,250	49,000	.0050		
12,500	50,000	.0113		
12,750	51,000	.0124		
13,000	52,000	.0137		
13,250	53,000	.0151		
13,500	54,000	.0169		
13,750	55,000	.0185	.0115	
14,000	56,000	.0203		
14,250	57,000	.0213		
14,500	58,000	.0231		
14,750	59,000	.0250		
15,000	60,000	.0270	.0190	
15,500	62,000	.0308		
16,000	64,000	.0335		
16,500	66,000	.0376		
17,000	68,000	.0420		
17,500	70,000	.0464	.0360	
18,500	74,000	.06		
19,500	78,000	.07		
20,500	82,000	.08		
21,500	86,000	.09		
22,500	90,000	.10		
23,500	94,000	.12		
24,500	98,000	.16		
25,140	100,500			Tensile strength.
0	0	.16		= 5.3 per cent.

Elongation of inch sections: ".03, ".05, ".08.\*

Diameter at fracture, ".54. Area, .229 square inch.

Contraction of area, 8.4 per cent.

Fractured ".15 from neck; appearance, granular 95 per cent, flaky streak 5 per cent.

No. 4633.

Marks, 6.

Diameter, ".564.

Sectional area, .25 square inch.

Gauged length, 3".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
250	1,000	0.	0.	Initial load.
1,250	5,000	.0003	0.	
2,500	10,000	.0008	0.	
5,000	20,000	.0018	0.	
7,500	30,000	.0028	0.	
10,000	40,000	.0039	0.	
12,500	50,000	.0050	.0002	
12,750	51,000	.0051	-----	
13,000	52,000	.0052	-----	
13,250	53,000	.0053	-----	
13,500	54,000	.0054	-----	
13,750	55,000	.0072	-----	
14,000	56,000	.0079	-----	
14,250	57,000	.0086	-----	
14,500	58,000	.0100	-----	
14,750	59,000	.0110	-----	
15,000	60,000	.0123	.0055	
15,500	62,000	.0153	-----	
16,000	64,000	.0180	-----	
16,500	66,000	.0210	-----	
17,000	68,000	.0242	-----	
17,500	70,000	.0278	.0188	
18,000	72,000	.0297	-----	
18,500	74,000	.0333	-----	
19,000	76,000	.0363	-----	
19,500	78,000	.0403	-----	
19,520	78,060	-----	-----	Tensile strength. -- 1.7 per cent.
0.	0.	.05	-----	

Elongation of inch sections, ".01, ".01, ".03.

Contraction of area inappreciable.

Fractured at the neck. Appearance, granular, streak of flaky metal across fractured surface.

H. Ex. 43—31

No. 4634.

Marks, 6.

Diameter, ".564.

Sectional area, .25 square inch.

Gauged length, 3".

Specimen taken from near outside surface of tire.

Applied loads.		In gauged lengths.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
250	1,000	0.	0.	
1,250	5,000	.0003	0.	Elastic limit.
2,500	10,000	.0009	.....	
5,000	20,000	.0019	.....	
7,500	30,000	.0030	0.	
10,000	40,000	.0042	0.	
11,250	45,000	.0048	.....	
11,500	46,000	.0049	.....	
11,750	47,000	.0051	.....	
12,000	48,000	.0052	.....	
12,250	49,000	.0057	.....	
12,500	50,000	.0059	.0003	
12,750	51,000	.0062	.....	
13,000	52,000	.0065	.....	
13,250	53,000	.0068	.....	
13,500	54,000	.0073	.....	
13,750	55,000	.0079	.0019	
14,000	56,000	.0087	.....	
14,250	57,000	.0098	.....	
14,500	58,000	.0109	.....	
14,750	59,000	.0114	.....	
15,000	60,000	.0129	.0059	
15,500	62,000	.0155	.....	
16,000	64,000	.0182	.....	
16,500	66,000	.0213	.....	
17,000	68,000	.0243	.....	
17,500	70,000	.0281	.0190	
19,000	76,000	.04	.....	
20,500	82,000	.05	.....	
22,000	88,000	.06	.....	
23,500	94,000	.08	.....	
25,000	100,000	.10	.....	
26,250	105,000	.....	.....	
0.	0.	.10	.....	
				Tensile strength. =3.3 per cent.

Elongation of inch sections: ".04, ".03, ".03.

Contraction of area inappreciable.

Fractured at neck. Appearance, granular.

TABULATION OF TENSION SPECIMENS FROM DRIVING WHEEL TIRES.

No. of test.	No. of tire.	Diam. clear.	Sec. tional area.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation in 3 inches.		Contraction of area.	Fracture.	Elongation of inch sections.
						Inch.	Per ct.			
4628	1	.564	.25	49,000	109,660	.28	9.3	Per cent. 15.0	3/4" from neck. Granular.	.16*
4629	2	.564	.25	42,000	88,960	.63	20.7	33.5	1 1/10 from neck. Granular silky center.	.29*
4630	3	.564	.25	42,000	57,800	.04	1.3	Inappreciable.	1 1/3 from neck. Granular with belt of flaky metal across middle of fracture.	.01, .02, .01
4631	4	.564	.25	55,000	114,240	.14	4.7	4.8	1/15 from neck. Medium fine granular flaky.	.07*
4632	5	.564	.25	45,000	100,560	.16	5.3	8.4	At neck. Granular 95 per cent. flaky streak 5 per cent.	.08, .05, .08*
4633	6	.564	.25	52,000	78,080	.06	1.7	Inappreciable.	At neck. Granular. streak of flaky metal across fractured surface.	.01, .01, .03
4634	*6	.564	.25	48,000	105,000	.10	3.3	Inappreciable.	At neck. Granular.	.04, .03, .03

\* Specimen taken from near outside surface of tire.





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# STEEL RAILS.

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## TRANSVERSE TESTS AND TENSION TESTS.



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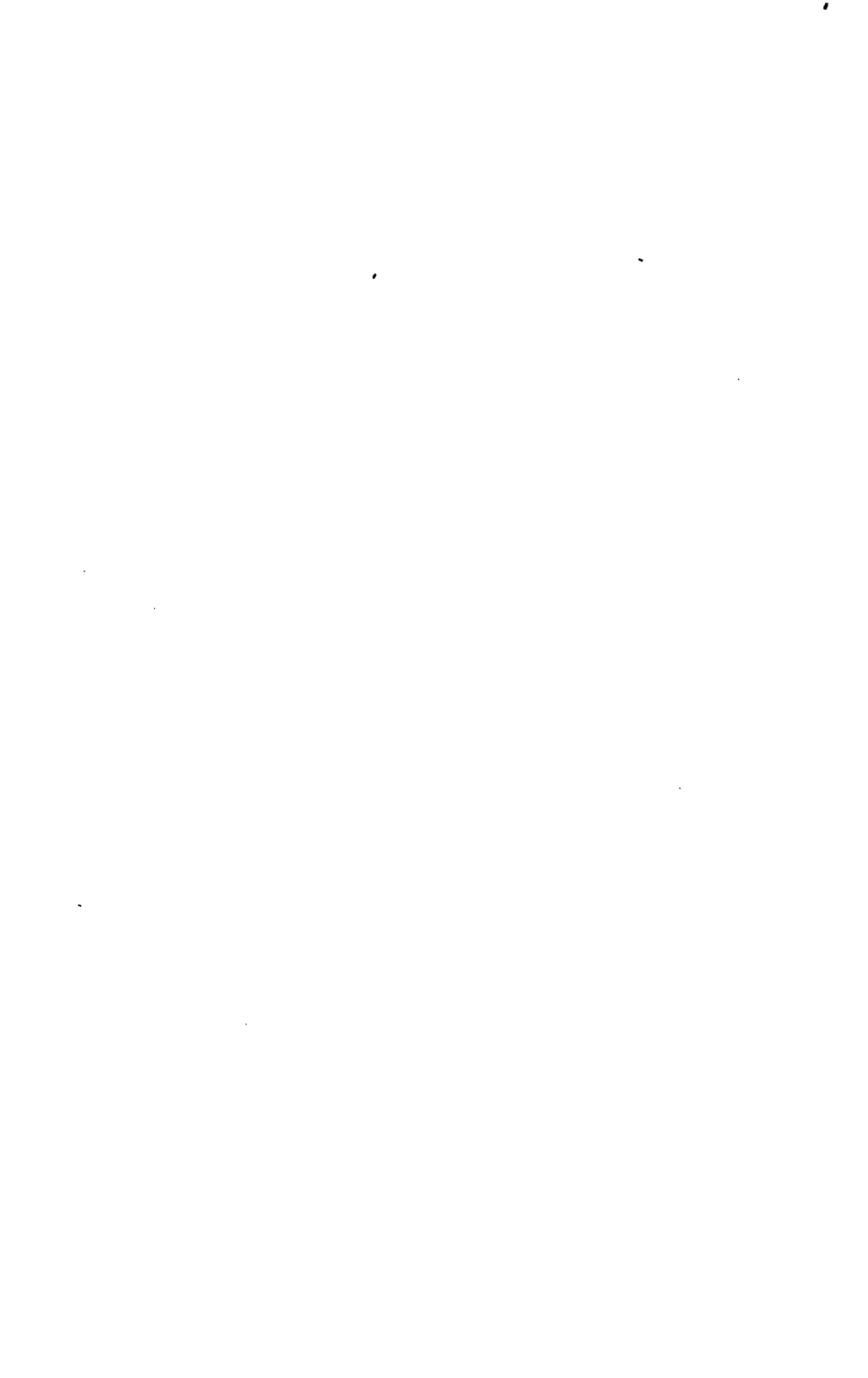
# STEEL RAILS.

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TRANSVERSE TESTS AND TENSION TESTS.

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## STEEL RAILS.

### CHEMICAL ANALYSES OF HEADS.

Physical tests published in Report of 1891 of rails, Nos. 28 to 37; Nos. 38 and 39 published herewith.

No. of rail.	Brand.	Chemical composition.					
		C.	Mn.	Si.	S.	P.	Cu.
28	Barrow Steel 1873 : : : : 55	0.172	0.286	0.143	0.050	0.065	0.021
31	Dowlais Steel 7-70 Guaranteed	0.405	0.474	0.045	0.060	0.080	0.052
33	Scranton Steel Co. 3-39	0.481	0.080	0.057	0.084	0.083	0.680
35	C. R. M. Co. 12-75	0.393	0.387	0.019	0.063	0.100	0.070
36	Wilson Cammel Co's Steel Sec 6-74 Dronfield	0.371	0.504	0.210	0.072	0.074	0.068
37	do	0.350	0.453	0.275	0.100	0.001	0.078
38	Troy S & I Co. 1886-7	0.359	0.858	0.122	0.110	0.060	0.175
39	do	0.350	0.847	0.103	0.108	0.060	0.303

No. 196.

## OLD STEEL RAIL NO. 33.

Branded "Troy S & I Co 1886 7".  
 Length, 122'".8.  
 Total weight, 218½ pounds.  
 Weight per yard, 64 pounds.  
 Ends supported 48' apart.  
 Loaded on the base at the middle.

Applied loads.		Deflections.	Successive deflections.	Deflection sets.	Remarks.
Total.	Maximum fiber stress.				
Pounds.	Pounds.	Inches.	Inch.	Inch.	
2,000	.....	0.	0.	0.	Initial load.
4,000	.....	.0168	.0168	.....	
6,000	.....	.0337	.0169	.....	
8,000	.....	.0474	.0137	.....	
10,000	.....	.0614	.0140	.0011	
12,000	.....	.0750	.0136	.....	
14,000	.....	.0876	.0126	.....	
16,000	.....	.0998	.0122	.....	
18,000	.....	.1115	.0117	.....	
20,000	.....	.1235	.0120	.0024	
24,000	.....	.13	.0065	.....	
28,000	.....	.15	.02	.....	
32,000	.....	.19	.04	.....	
36,000	.....	.21	.02	.....	
40,000	.....	.25	.04	.....	
44,000	.....	.34	.09	.....	
48,000	.....	.51	.17	.....	
52,000	.....	.80	.29	.....	
56,000	.....	1.11	.31	.....	
57,800	101,180	.....	.....	.....	Ultimate strength.

Granular appearance, radiating from one corner of the head. The metal from the surface of the head to a depth of ".04" presented a smooth sheared appearance.

The rail took a permanent bend of 4° at the time of rupture.

Maximum fiber stress computed by the formula  $R = \frac{P l d}{4 I}$ , in which

R = maximum fiber stress.

P = load applied, pounds.

l = length of rail between end supports.

d = distance from neutral axis to most remote fiber.

I = moment of inertia of cross section taken about the neutral axis.

No. 197.

From same rail as No. 196.  
 Ends supported 48'' apart.  
 Loaded on the head at the middle.

Applied loads.		Deflections.	Successive deflections.	Deflection sets.	Remarks.
Total.	Maximum fiber stress.				
Pounds.	Pounds.	Inch.	Inch.	Inch.	
2,000		0.	0.	0.	Initial load.
4,000		.0148	.0148		
6,000		.0310	.0162		
8,000		.0445	.0185		
10,000		.0584	.0139	.0010	
12,000		.0700	.0118		
14,000		.0832	.0132		
16,000		.0955	.0123		
18,000		.1083	.0128		
20,000		.1200	.0117	.0020	
22,000		.1340	.0140		
24,000		.1446	.0106		
26,000		.1572	.0126		
28,000		.1700	.0128		
30,000		.1820	.0120	.0046	
32,000		.1955	.0135		
34,000		.2106	.0151		
36,000		.2260	.0154		
38,000		.2475	.0215		
40,000		.2884	.0409	.0487	
42,000		.3435	.0551		
44,000		.4334	.0899		
46,000		.53	.0966		
48,000		.64	.11		
50,000		.81	.17		
52,000		.96	.15		
54,000		1.13	.17		
56,000		1.34	.21		
58,000		1.58	.24		
60,000		1.88	.30		
72,800	127,440	4.95	3.07		Maximum load applied with end supports 48'' apart.
Distance between end supports reduced to 36''.					
108,000	141,790				Ultimate strength.

Appearance of fracture, granular, radiating from a silky section at an outside corner of the base.

The metal adjacent to the surface of the head, and to a depth of  $.04 \pm$ , had a smooth oblique, sheared appearance.

The rail took a permanent bend of  $36^\circ$  at the time of rupture.

No. 198.

End of same rail as tests Nos. 196 and 197.

Ends supported 36'' apart.

Loaded on the base at the middle.

The section along the middle of the length, at the middle bearing, was heated full red and cooled in the open air.

Under transverse load the maximum resistance was 92,400 pounds = 126,930 pounds maximum fiber stress.

Deflections were continued until the rail was bent  $30^\circ$ , when the test was discontinued.

The flanges buckled and the rail bent obliquely. There were no indications of fracture when the test ended.

## TENSION SPECIMEN FROM HEAD OF STEEL RAIL NO. 38.

No. 4763.

Diameter, ".798.

Sectional area, .50 square inch.

Gauged length, 5".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
500	1,000	0.	0.	
2,500	5,000	.0008	.....	Elastic limit not well defined.
5,000	10,000	.0016	.....	
10,000	20,000	.0033	.....	
12,500	25,000	.0041	.....	
15,000	30,000	.0050	.0002	
17,500	35,000	.0059	.....	
20,000	40,000	.0070	.0004	
20,500	41,000	.0072	.....	
21,000	42,000	.0074	.....	
21,500	43,000	.0076	.....	
22,000	44,000	.0079	.....	
22,500	45,000	.0083	.0008	
23,000	46,000	.0086	.....	
23,500	47,000	.0090	.....	
24,000	48,000	.0101	.....	
24,500	49,000	.0129	.....	
25,000	50,000	.0169	.0083	
25,500	51,000	.0209	.....	
26,000	52,000	.0232	.....	
26,500	53,000	.0275	.....	
27,000	54,000	.0312	.....	
27,500	55,000	.0344	.....	
28,000	56,000	.0392	.....	
28,500	57,000	.0430	.....	
29,000	58,000	.0470	.....	
29,500	59,000	.0510	.....	
30,000	60,000	.0555	.0436	
31,000	62,000	.065	.....	
32,000	64,000	.075	.....	
33,000	66,000	.085	.....	
34,000	68,000	.095	.....	
35,000	70,000	.105	.....	
36,000	72,000	.115	.....	
37,000	74,000	.13	.....	
38,000	76,000	.14	.....	
39,000	78,000	.15	.....	
40,000	80,000	.17	.....	
41,000	82,000	.19	.....	
42,000	84,000	.21	.....	
43,000	86,000	.23	.....	
44,000	88,000	.25	.....	
45,000	90,000	.27	.....	
46,000	92,000	.27	.....	
47,000	94,000	.27	.....	
48,000	96,000	.27	.....	
49,000	98,000	.27	.....	
50,000	100,000	.55	.....	
50,180	100,360	.....	.....	
0.	0.	.81	.....	

Rested 48 hours without load.

Tensile strength.  
= 16.2 per cent.

Elongation of inch sections; ".15, ".32\*, ".13, ".11, ".10.

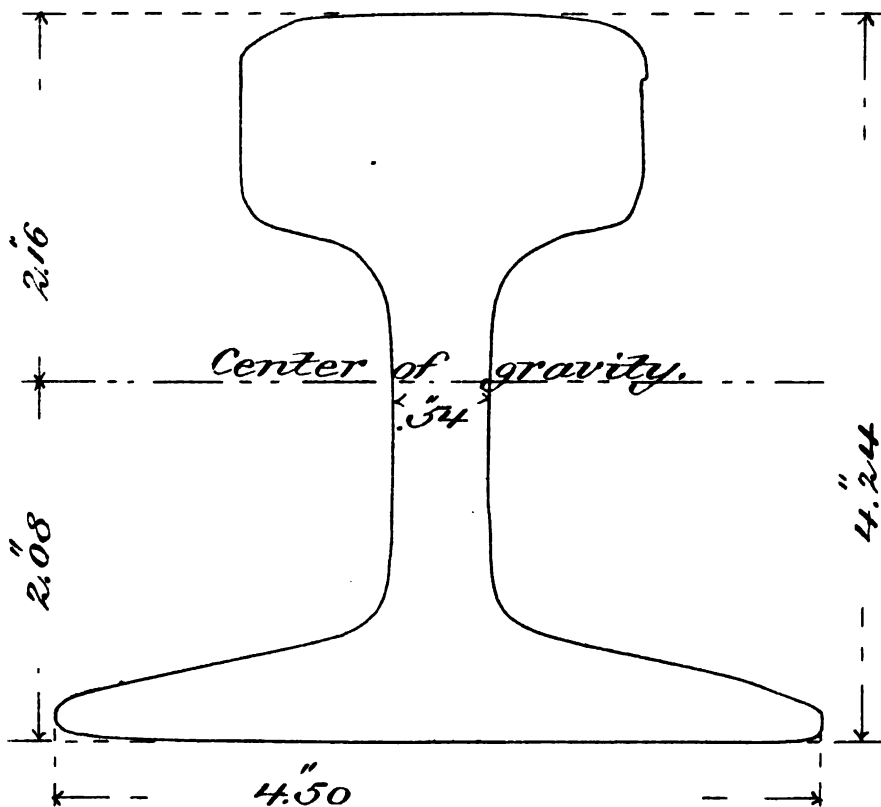
Diameter at fracture, ".66. Area, .342 square inch.

Contraction of area, 31.6 per cent.

Fractured 1".75 from neck. Appearance, silky, interspersed with fine granulation.



*Steel rail No. 38*

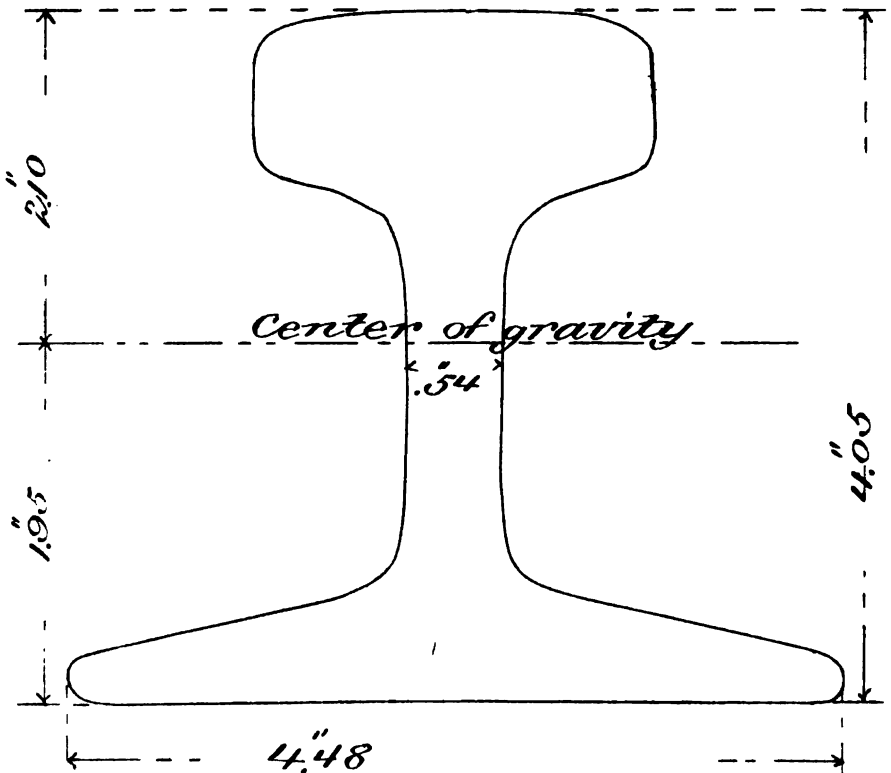


*Moment of Inertia 14.807*





# Steel rail No. 39



Moment of Inertia 13.731

No. 199.

OLD STEEL RAIL No. 39.

Branded "Troy S & I Co. 1886 7".

Length, 121'' .45.

Total weight, 209½ pounds.

Weight per yard, 62.1 pounds.

Ends supported 48'' apart.

Loaded on the base at the middle.

Applied loads.		Deflections.	Successive deflections.	Deflection sets.	Remarks.
Total.	Maximum fiber stress.				
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
2,000		0.	0.	0.	Initial load.
4,000		.0172	.0172		
6,000		.0360	.0188		
8,000		.0506	.0146		
10,000		.0660	.0154	.0003	
12,000		.0805	.0145		
14,000		.0946	.0141		
16,000		.1088	.0142		
18,000		.1225	.0137		
20,000		.1366	.0141	.0033	
22,000		.1520	.0154		
24,000		.1665	.0145		
26,000		.1828	.0163		
28,000		.2005	.0177		
30,000		.2212	.0207	.0211	
32,000		.24	.0188		
34,000		.26	.02		
36,000		.28	.02		
38,000		.33	.05		
40,000		.40	.07		
42,000		.47	.07		
44,000		.57	.10		
45,900	84,240				Ultimate strength.

Appearance of fracture, granular, radiating from one corner of the top surface of the head.

The metal from the top surface of the head to a depth of ".04 to ".05 presented a smooth sheared appearance.

The rail was permanently bent 2° at the time of rupture.

No. 200.

From same rail as No. 199.  
Ends supported 48" apart.  
Loaded on the head at the middle.

Applied loads.		Deflections.	Successive deflections.	Deflection sets.	Remarks.
Total.	Maximum fiber stress.				
Pounds.	Pounds.	Inch.	Inch.	Inch.	
2,000		C.	0.	0.	Initial load.
4,000		.0195	.0195		
6,000		.0374	.0179		
8,000		.0520	.0146		
10,000		.0668	.0146	0.	
12,000		.0876	.0210		
14,000		.0946	.0070		
16,000		.1081	.0135		
18,000		.1215	.0134		
20,000		.1345	.0130	.0014	
22,000		.1486	.0141		
24,000		.1617	.0131		
26,000		.1748	.0131		
28,000		.1879	.0131		
30,000		.2018	.0139	.0040	
32,000		.2165	.0147		
34,000		.2305	.0140		
36,000		.2454	.0149		
38,000		.2631	.0177		
40,000		.2888	.0257	.0286	
42,000		.3395	.0507		
44,000		.4180	.0785		
46,000		.51	.0920		
48,000		.63	.12		
50,000		.78	.15		
52,000		.94	.16		
54,000		1.16	.22		
56,000		1.59	.43		
2,000					Rested two hours under this load.
58,000		1.63	.04		
60,000		1.67	.04		
62,000		2.18	.51		
64,000		2.60	.42		
66,000		2.98	.38		
68,000		3.57	.59		
70,000		4.31	.74		
76,000	139,480	5.00	.69		
107,000	147,280	Distance between end supports reduced to 30".			
127,600	146,360	Distance between end supports reduced to 30".			Maximum stress reached.

The load fell to 126,200 pounds when the rail had deflected so far as to come into contact with the transverse supporting beam of the testing machine.

The load was now removed and distance between end supports reduced to 24".

Under 148,200 pounds=135,990 pounds maximum fiber stress, the rail fractured.

Appearance of fracture, granular; radiating from a silky section  $\frac{3}{4}$ " wide at the edge of the base.

The metal next the head to a depth of ".04 to ".05 had a smooth sheared appearance.

The rail was permanently bent  $41\frac{1}{2}$  degrees at the time of rupture.

No. 201.

Part of same rail used in tests Nos. 199 and 200. Tested for bending only. Ends supported 36" apart. Loaded on the base at the middle. Before testing, the middle section was heated full red and cooled in the open air. The rail was bent 28° without signs of fracture. Deflection took an oblique course; the flanges buckled.

TENSION SPECIMEN FROM HEAD OF STEEL RAIL No. 39.

No. 4764.

Diameter, ".798.

Sectional area, .50 square inch.

Gauged length, 5".

Applied loads.		In gauged length.		Remarks.	
Total.	Per square inch.	Elongation.	Set.		
Pounds.	Pounds.	Inch.	Inch.		
500	1,000	0.	0.	Initial load.	
2,500	5,000	.0008	0.		
5,000	10,000	.0018	.....		
10,000	20,000	.0033	.....		
15,000	30,000	.0050	.0.		
17,500	35,000	.0058	.....		
20,000	40,000	.0067	.0001		
20,500	41,000	.0069	.....		
21,000	42,000	.0070	.....		
21,500	43,000	.0072	.....		
22,000	44,000	.0075	.....		
22,500	45,000	.0077	.0002		
23,000	46,000	.0080	.....		
23,500	47,000	.0083	.....		
24,000	48,000	.0085	.....		
24,500	49,000	.0088	.0022		Elastic limit.
25,000	50,000	.0091			
25,500	51,000	.0106	.....		
26,000	52,000	.0115	.....		
26,500	53,000	.0125	.....		
27,000	54,000	.0144	.....		
27,500	55,000	.0158	.....		
28,000	56,000	.0188	.....		
28,500	57,000	.0229	.....		
29,000	58,000	.0300	.....		
29,500	58,000	.0510	.....		
30,000	59,000	.0613	.....		
30,000	60,000	.0654	.0537		
31,000	62,000	.0732	.....		
32,000	64,000	.0820	.....		
33,000	66,000	.0915	.....		
34,000	68,000	.1042	.....		
35,000	70,000	.1131	.....		
36,000	72,000	.1260	.....		
37,000	74,000	.1375	.....		
38,000	76,000	.1525	.....		
39,000	78,000	.1666	.....		
40,000	80,000	.1815	.....	Rested 48 hours without load.	
41,000	82,000	.18+	.....		
42,000	84,000	.18+	.....		
43,000	86,000	.18+	.....		
44,000	88,000	.19	.....		
44,500	89,000	.26	.....		
45,000	90,000	.28	.....		
45,500	91,000	.30	.....		
46,000	92,000	.33	.....		
47,000	94,000	.38	.....		
48,000	96,000	.49	.....		
48,620	97,240	.....	f.....	Tensile strength. =14.2 per cent.	
0	0	.71	.....		

Elongation of inch sections: ".25", ".14", ".12", ".11", ".09. Diameter at fracture, ".70. Area, .385 square inch. Contraction of area, 23.0 per cent. Fractured, ".75 from neck. Appearance, granular, dull spot at circumference.

**COLD ROLLED IRON SHAFT, 1 1-4 INCHES DIAMETER.***Chemical composition of specimen No. 4639.*

Total carbon .....	0. 036
Graphitic carbon .....	0. 009
Combined carbon .....	0. 027
Manganese .....	None.
Silicon .....	0. 253
Sulphur .....	0. 014
Phosphorus .....	0. 123
Copper .....	None.

These experiments were made for the purpose of showing the effect of annealing, at different temperatures, on cold rolled iron.

While there was apparently some loss in tensile strength after annealing at lower temperatures, a decided loss occurred after exposed to a temperature of 683° Fahr. The elastic limits had remained undisturbed up to this temperature. At this time the tensile curve begins to show a jog at or in the vicinity of the elastic limit. This phase in the state of the metal is at first marked by the specimen developing considerable stretch at the elastic limit without increase of stress.

After annealing at 980° Fahr. the jog was more pronounced; now the metal, soon after passing the elastic limit, stretched under diminished loads.

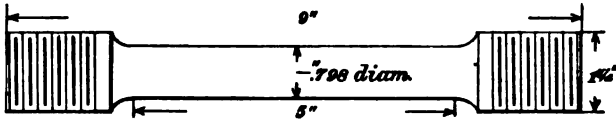
This behavior continued until annealing at 1768° Fahr., when the jog disappeared, but the elastic limit by this annealing temperature was brought very low, and the total elongation was greater than displayed by the other specimens at that point of the curve where the jog had occurred.

The elastic limit, it appears, was lowered by annealing at a more rapid rate than the tensile strength.

The specimen heated bright cherry red and suddenly cooled by quenching in brine showed higher tensile strength than the corresponding specimen which was cooled from the same heat in oil, and the elongation under stresses between the elastic limit and tensile strength were much less in the former than the latter specimen.



EIGHTEEN TENSION SPECIMENS TAKEN FROM SHAFT.



No. 4638.

Marks, C. R.  
 Diameter, ".798.  
 Sectional area, .50 square inch.  
 Gauged length, 5\"".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
500	1,000	0.	0.	
2,500	5,000	.0007	0.	Elastic limit. (Approximate.)
5,000	10,000	.0016	0.	
7,500	15,000	.0029	.0002	
10,000	20,000	.0034	.0002	
12,500	25,000	.0044	.0002	
15,000	30,000	.0053	.0002	
17,500	35,000	.0062	.0002	
20,000	40,000	.0072	.0002	
22,500	45,000	.0081		
23,000	46,000	.0084		
23,500	47,000	.0087		
24,000	48,000	.0089		
24,500	49,000	.0094	.0005	
25,000	50,000	.0097		
25,500	51,000	.0104		
26,000	52,000	.0110		
26,500	53,000	.0119		
27,000	54,000	.0139	.0063	
27,500	55,000	.0162		
28,000	56,000	.0194		
29,500	57,000	.0233		
29,000	58,000	.0296		
29,500	59,000	.0380		
30,000	60,000	.0530	.0411	
31,000	62,000	.09		
32,000	64,000	.15		
33,000	66,000	.25		
33,780	67,560			Tensile strength. =13.6 per cent.
0	0	.68		

Elongation of inch sections: ".11, ".30\*, ".11, ".09, ".07.  
 Diameter at fracture, ".65. Area, .332 square inch.  
 Contraction of area, 33.6 per cent.  
 Fractured 1".8 from neck. Appearance, fibrous.

No. 4639.

Marks, C R.  
 Diameter, ".798.  
 Sectional area, .50 square inch.  
 Gauged length, 5".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	Pounds.	Inch.	Inch.	
500	1,000	0.	0.	Initial load.
2,500	5,000	.0007	0.	
5,000	10,000	.0014	0.	
10,000	20,000	.0034	0.	
15,000	30,000	.0052		
20,000	40,000	.0071	.0001	
22,500	45,000	.0082	.0001	
23,000	46,000	.0084		
23,500	47,000	.0086		
24,000	48,000	.0089		
24,500	49,000	.0093		Elastic limit (approximate).
25,000	50,000	.0095	.0005	
25,500	51,000	.0100		
26,000	52,000	.0104		
26,500	53,000	.0108		
27,000	54,000	.0111		
27,500	55,000	.0118	.0019	
28,000	56,000	.0125		
28,500	57,000	.0131		
29,000	58,000	.0145		
29,500	59,000	.0170		Rested under this load fourteen hours.
30,000	60,000	.0218	.0109	
5,000	10,000			
29,500	59,000	.0218		
30,000	60,000	.0222		
30,500	61,000	.0224		
31,000	62,000	.0250		
31,500	63,000	.0250		
32,000	64,000	.1143	.1009	
2,500	5,000	.1017		
5,000	10,000	.1026		
7,500	15,000	.1037		
10,000	20,000	.1047		
12,500	25,000	.1055		
15,000	30,000	.1067		
17,500	35,000	.1077		
20,000	40,000	.1088		
22,500	45,000	.1099		
25,000	50,000	.1110		
22,500	45,000	.1102		
20,000	40,000	.1092		
17,500	35,000	.1083		
15,000	30,000	.1072		
12,500	25,000	.1061		
10,000	20,000	.1052		
7,500	15,000	.1042		
5,000	10,000	.1031		
2,500	5,000	.1020	.1010	
32,500	65,000	.1235		
33,000	66,000	.18		
33,500	67,000	.24		
33,650	67,320	.28		
0.	0.	.48		Tensile strength. =9.6 per cent.

Elongation of inch sections: ".04, ".05, ".06, ".07, ".26\*.  
 Diameter at fracture, ".65. Area, .332 square inch.  
 Contraction of area, 33.6 per cent.  
 Fractured ".8 from neck. Appearance fibrous.

Two specimens, Nos. 4640 and 4641, heated in oil bath to 200° Fahr., kept at this temperature two hours, then cooled to 70° Fahr. and tested.

No. 4640.

Marks, C R.  
 Diameter, ".798.  
 Sectional area, .50 per square inch.  
 Gauged length, 5".  
 Annealed at 200° Fahr.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
500	1,000	0.	0.	
2,500	5,000	.0008	0.	Elastic limit.
5,000	10,000	.0017	0.	
7,500	15,000	.0027	0.	
10,000	20,000	.0036	0.	
12,500	25,000	.0045	0.	
15,000	30,000	.0053	0.	
17,500	35,000	.0062	0.	
20,000	40,000	.0070	0.	
22,500	45,000	.0080	.0002	
25,000	48,000	.0083	0.	
28,000	47,000	.0087	0.	
24,000	48,000	.0082	0.	
24,500	49,000	.0102	0.	
25,000	50,000	.0111	.0019	
25,500	51,000	.0127	0.	
26,000	52,000	.0153	0.	
26,500	53,000	.0183	0.	
27,000	54,000	.0241	0.	
27,500	55,000	.0325	.0218	
28,000	56,000	.0386	0.	
28,500	57,000	.0576	0.	
29,000	58,000	.0720	0.	
29,500	59,000	.0989	0.	
30,000	60,000	.1255	.1126	
30,500	61,000	.14	0.	
31,000	62,000	.19	0.	
31,500	63,000	.27	0.	
32,000	64,000	.40	0.	
0.	0.	.65	0.	Tensile strength. =13.0 per cent.

Elongation of inch sections: ".09, ".31\*, ".09, ".09, ".07.

Diameter of fracture, ".65. Area .332 square inch.

Contraction of area, 33.6 per cent.

Fractured 1".7 from neck. Appearance, fibrous,

No. 4641.

Marks, C R.  
 Diameter, ".793.  
 Sectional area, .50 square inch.  
 Gauged length, 5".  
 Annealed at 200° Fahr.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
500	1,000	0.	0.	
2,500	5,000	.0009	0.	Elastic limit (approximate).
5,000	10,000	.0018		
10,000	20,000	.0037		
12,500	25,000	.0046		
15,000	30,000	.0056	.0002	
17,500	35,000	.0063	.0002	
20,000	40,000	.0071	.0001	
21,000	42,000	.0074		
21,500	43,000	.0077		
22,000	44,000	.0079		
22,500	45,000	.0082	.0002	
23,000	46,000	.0084		
23,500	47,000	.0086		
24,000	48,000	.0090		
24,500	49,000	.0094		
25,000	50,000	.0100	.0009	
25,500	51,000	.0107		
26,000	52,000	.0117		
26,500	53,000	.0130		
27,000	54,000	.0164		
27,500	55,000	.0190	.0098	
28,000	56,000	.0227		
28,500	57,000	.0293		
29,000	58,000	.0307		
29,500	59,000	.0512		
30,000	60,000	.0714	.0597	
30,500	61,000	.0865		
31,000	62,000	.1200		
31,500	63,000	.14		
32,000	64,000	.19		
32,500	65,000	.24		
33,000	66,000	.33		
33,200	66,400			Tensile strength. = 15.6 per cent.
0.	0.	.78		

Elongation of inch sections: ".08, ".14, ".35\*, ".13, ".08.  
 Diameter at fracture, ".64. Area, .322 square inch.  
 Contraction of area, 35.6 per cent.  
 Fractured 3" from neck. Appearance, fibrous.

Nos. 4642 and 4643 annealed two hours at 200° Fahr. and one and one-half hours at 300° Fahr.

No. 4642.

Marks, C R.

Diameter, ".798.

Sectional area, .50 square inch.

Gauged length, 5".

Annealed at 300° Fahr.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
500	1,000	0.	0.	Initial load.
2,500	5,000	.0007	0.	
5,000	10,000	.0018	0.	
7,500	15,000	.0025	-----	
10,000	20,000	.0033	.0001	
12,500	25,000	.0042	-----	
15,000	30,000	.0052	.0001	
17,500	35,000	.0062	-----	
19,000	38,000	.0068	-----	
20,000	40,000	.0070	.0001	
22,500	45,000	.0080	.0001	
23,000	46,000	.0081	-----	
23,500	47,000	.0083	-----	
24,000	48,000	.0085	-----	
24,500	49,000	.0088	-----	
25,000	50,000	.0093	.0005	
25,500	51,000	.0102	-----	
26,000	52,000	.0133	-----	
26,500	53,000	.0216	-----	
27,000	54,000	.0270	-----	
27,500	55,000	.0387	.0283	
28,000	56,000	.0489	-----	
28,500	57,000	.0663	-----	
29,000	58,000	.0848	-----	
29,500	59,000	.1060	-----	
30,000	60,000	.1400	.1274	
30,500	61,000	.16	-----	
31,000	62,000	.21	-----	
31,500	63,000	.27	-----	
32,000	64,000	.34	-----	
32,050	64,100	-----	-----	Tensile strength.
0	0	.67	-----	=13.4 per cent.

Elongation of inch sections: ".30,\* ".13, ".10, ".08, ".06.

Diameter at fracture, ".64. Area, .322 square inch.

Contraction of area, 35.6 per cent.

Fractured 1" from the neck. Appearance, fibrous.

No. 4643.

Marks, C R.  
 Diameter, ".798.  
 Sectional area, .50 square inch.  
 Gauged length, 5".  
 Annealed at 300° Fahr.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
500	1,000	0.	0.	
2,500	5,000	.0008	0.	
5,000	10,000	.0017	-----	
7,500	15,000	.0027	-----	
10,000	20,000	.0035	.0001	
12,500	25,000	.0044	-----	
15,000	30,000	.0053	.0001	
17,500	35,000	.0061	-----	
20,000	40,000	.0071	.0002	
20,500	41,000	.0073	-----	
21,000	42,000	.0075	-----	
21,500	43,000	.0077	-----	
22,000	44,000	.0078	-----	
22,500	45,000	.0081	0.	
26,000	52,000	.0103	-----	
26,500	53,000	.0114	-----	
27,000	54,000	.0190	-----	
27,500	55,000	.0243	.0139	
28,000	56,000	.0322	-----	
28,500	57,000	.0419	-----	
29,000	58,000	.0542	-----	
29,500	59,000	.0753	-----	
30,000	60,000	.0832	.0612	
30,500	61,000	.1200	-----	
31,000	62,000	.1510	-----	
31,500	63,000	.19	-----	
32,000	64,000	.23	-----	
32,500	65,000	.31	-----	
32,940	65,880	-----	-----	
0.	0.	.71	-----	
				Tensile strength. =14.2 per cent.

Elongation of inch sections: ".07, ".10, ".10, ".20\*, ".24\*.  
 Diameter at fracture, ".63; area, .312 square inch.  
 Contraction of area, 37.6 per cent.  
 Fractured 1".24 from neck. Appearance, fibrous.

No. 4644.

Marks, C R.  
 Diameter, ".798.  
 Sectional area, .50 square inch.  
 Gauged length, 5".  
 Annealed at 400° Fahr., one hour.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
500	1,000	0.	0.	
2,500	5,000	.0007	0.	Elastic limit.
5,000	10,000	.0017	.....	
7,500	15,000	.0026	.....	
10,000	20,000	.0034	0.	
12,500	25,000	.0043	.....	
15,000	30,000	.0052	.0001	
17,500	35,000	.0062	.....	
20,000	40,000	.0071	.0001	
20,500	41,000	.0072	.....	
21,000	42,000	.0074	.....	
21,500	43,000	.0076	.....	
22,000	44,000	.0078	.....	
22,500	45,000	.0080	.0002	
23,000	46,000	.0083	.....	
23,500	47,000	.0085	.....	
24,000	48,000	.0087	.....	
24,500	49,000	.0089	.0004	
25,000	50,000	.0093	.....	
25,500	51,000	.0097	.....	
26,000	52,000	.0102	.....	
26,500	53,000	.0114	.....	
27,000	54,000	.0238	.....	
27,500	55,000	.0300	.0199	
28,000	56,000	.0370	.....	
28,500	57,000	.0526	.....	
29,000	58,000	.0678	.....	
29,500	59,000	.0893	.....	
30,000	60,000	.1122	.1005	
30,500	61,000	.1350	.....	
31,000	62,000	.1770	.....	
31,500	63,000	.21	.....	
32,000	64,000	.28	.....	
32,500	65,000	.41	.....	
32,520	65,040	.....	.....	Tensile strength.
0.	0.	.72	.....	= 14.4 per cent.

Elongation of inch sections: ".08, ".15, ".29\*, ".10, ".10.  
 Diameter at fracture, ".64. Area, .322 square inch.  
 Contraction of area, 35.6 per cent.  
 Fractured 1".7 from neck. Appearance, fibrous.

No. 4645.

Marks, C R.

Diameter, ".798.

Sectional area, .50 square inch.

Expansion, ".0202 in 6 inches.

Estimated annealing temperature, 567° Fahr.

Gauged length, 5".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
500	1,000	0.	0.	Initial load.
2,500	5,000	.0005	0.	
5,000	10,000	.0017		
7,500	15,000	.0026		
10,000	20,000	.0034		
12,500	25,000	.0045		
15,000	30,000	.0053	.0002	
17,500	35,000	.0063		
20,000	40,000	.0072	.0002	
20,500	41,000	.0074		
21,000	42,000	.0076		
21,500	43,000	.0078		
22,000	44,000	.0080		
22,500	45,000	.0082		
23,000	46,000	.0084		
23,500	47,000	.0087		
24,000	48,000	.0089		
24,500	49,000	.0092		Elastic limit.
25,000	50,000	.0097	.0008	
25,500	51,000	.0112		
26,000	52,000	.0240		
26,500	53,000	.0325		
27,000	54,000	.0400		
27,500	55,000	.0561		
28,000	56,000	.0720		
28,500	57,000	.0910		
29,000	58,000	.1120		
29,500	59,000	.1350		
30,000	60,000	.1605	.1597	
30,500	61,000	.19		
31,000	62,000	.26		
31,500	63,000	.32		
31,970	63,940			Tensile strength.
0.	0.	.75		= 15 per cent.

Elongation of inch sections: ".08, ".12, ".32\*, ".14, ".09.

Diameter at fracture, ".63. Area, .312 square inch.

Contraction of area, 37.6 per cent.

Fractured 2".6 from neck. Appearance, fibrous.



No. 4646.

Marks, C R.

Diameter ".798.

Sectional area, .50 square inch.

Expansion ".0412 in 6 inches.

Estimated annealing temperature 1095° Fahr.

Gauged length, 5".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inches.</i>	<i>Inch.</i>	Initial load.
500	1,000	0.	0.	
2,500	5,000	.0008	0.	Elastic limit.
5,000	10,000	.0018	.....	
7,500	15,000	.0028	.....	
10,000	20,000	.0035	.....	
12,500	25,000	.0044	.....	
15,000	30,000	.0054	.0001	
17,500	35,000	.0064	.....	
19,000	36,000	.0066	.....	
18,500	37,000	.0069	.....	
19,000	38,000	.0072	.....	
19,500	39,000	.0139	.....	
20,000	40,000	.0575	.....	
20,500	41,000	.0700	.....	
21,000	42,000	.0850	.....	
21,500	43,000	.1025	.....	
22,000	44,000	.1200	.....	
22,500	45,000	.1405	.....	
23,000	46,000	.1610	.....	
23,500	47,000	.19	.....	
24,000	48,000	.22	.....	
24,500	49,000	.26	.....	
25,000	50,000	.30	.....	
25,500	51,000	.26	.....	
26,000	52,000	.44	.....	
26,500	53,000	.58	.....	
26,790	53,580	.....	.....	Tensile strength.
0.	0.	1.14	.....	=22.8 per cent.

Elongation of inch sections: ".21, ".43\*, ".22, ".17, ".11.

Diameter at fracture, ".60; area, .283 square inch.

Contraction of area, 43.4 per cent.

Fractured 1".4 from the neck. Appearance, fibrous.

No. 4647.

Marks, C R.

Diameter, ".798.

Sectional area, .50 square inch.

Expansion, ".0306 in 6 inches.

Estimated annealing temperature, 830° Fahr.

Gauged length, 5".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
500	1,000	0.	0.	Initial load.
2,500	5,000	.0008	.....	
5,000	10,000	.0017	.....	
7,500	15,000	.0026	.....	
10,000	20,000	.0035	.0001	
12,500	25,000	.0044	.....	
15,000	30,000	.0053	.0001	
17,500	35,000	.0063	.....	
19,000	38,000	.0067	.....	
19,500	39,000	.0070	.....	
20,000	40,000	.0072	.0002	
20,500	41,000	.0074	.....	
21,000	42,000	.0076	.....	
21,500	43,000	.0078	.....	Elastic limit (approximate).
22,000	44,000	.0082	.....	
22,500	45,000	.0085	.0006	
23,000	46,000	.0087	.....	
23,500	47,000	.0231	.....	
24,000	48,000	.0313	.....	
24,500	49,000	.0445	.....	
25,000	50,000	.0619	.0520	
25,500	51,000	.0712	.....	
26,000	52,000	.0844	.....	
26,500	53,000	.1149	.....	
27,000	54,000	.1400	.....	
27,500	55,000	.1654	.1537	
28,000	56,000	.19	.....	
28,500	57,000	.24	.....	
29,000	58,000	.29	.....	
29,500	59,000	.40	.....	
29,690	59,380	.....	.....	Tensile strength.
0.	0.	.73	.....	=14.6 per cent.

Elongation of inch sections, ".07, ".18, ".33\*, ".09, ".06.

Diameter at fracture, ".61. Area, .292 square inch.

Contraction of area, 41.6 per cent.

Fractured 2".5 from neck. Appearance, fibrous.



No. 4649.

Marks, C R.

Diameter, ".798.

Sectional area, .50 square inch.

Expansion, ".0366 in 6 inches.

Estimated annealing temperature, 980° Fahr.

Gauged length, 5".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
500	1,000	0.	0.	
2,500	5,000	.0006	0.	
5,000	10,000	.0015	.....	
7,500	15,000	.0024	.....	
10,000	20,000	.0033	.0001	
12,500	25,000	.0043	.....	
15,000	30,000	.0052	.0001	
15,500	31,000	.0054	.....	
16,000	32,000	.0056	.....	
16,500	33,000	.0058	.....	
17,000	34,000	.0060	.....	
17,500	35,000	.0062	.....	
18,000	36,000	.0064	.....	
18,500	37,000	.0066	.....	
19,000	38,000	.0069	.....	
19,500	39,000	.0071	.....	
20,000	40,000	.0073	.0008	
20,500	41,000	.0077	.....	
21,000	42,000	.0081	.....	
20,500	41,000	.0110	.....	
21,000	42,000	.0169	.....	
21,500	43,000	.0402	.....	
22,000	44,000	.0550	.....	
22,500	45,000	.0630	.....	
23,000	46,000	.1000	.....	
23,500	47,000	.1190	.....	
24,000	48,000	.1400	.....	
24,500	49,000	.1625	.....	
25,000	50,000	.1905	.....	
25,500	51,000	.24	.....	
26,000	52,000	.28	.....	
26,500	53,000	.32	.....	
27,000	54,000	.39	.....	
27,500	55,000	.51	.....	
27,700	55,400	.69	.....	
0	0	.96	.....	
				Elastic limit.
				Load fell.
				Tensile strength. = 19.2 per cent.

Elongation of inch sections: ".10, ".15, ".16, ".36\*, ".19.

Diameter at fracture, ".61. Area, .292 square inch.

Contraction of area, 41.6 per cent.

Fractured 1".4 from neck. Appearance, fibrous.

No. 4650.

Marks, C R.

Diameter, ".798.

Sectional area, .50 square inch.

Expansion, ".0412 in 6 inches.

Estimated annealing temperature, 1095° Fahr.

Gauged length, 5".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inches,</i>	<i>Inch.</i>	
500	1,000	0.	0.	Initial load.
2,500	5,000	.0007	0.	
5,000	10,000	.0017	.....	
7,500	15,000	.0026	.....	
10,000	20,000	.0034	.0001	
12,500	25,000	.0043	.....	
15,000	30,000	.0054	.0002	
16,000	32,000	.0058	.....	
17,000	34,000	.0062	.....	
17,500	35,000	.0064	.0003	
18,000	36,000	.0066	.....	Elastic limit.
18,500	37,000	.0071	.....	
19,000	38,000	.0074	.....	
19,500	39,000	.0080	.....	Load fell.
19,000	38,000	.0415	.....	
19,500	39,000	.0498	.....	
20,000	40,000	.0567	.0490	
20,500	41,000	.0770	.....	
21,000	42,000	.0805	.....	
21,500	43,000	.1094	.....	
22,000	44,000	.1270	.....	
22,500	45,000	.1515	.1420	
23,000	46,000	.16	.....	
23,500	47,000	.20	.....	
24,000	48,000	.23	.....	
24,500	49,000	.28	.....	
25,000	50,000	.30	.....	
25,500	51,000	.34	.....	
26,000	52,000	.48	.....	
26,500	53,000	.68	.....	
26,620	53,240	.....	.....	Tensile strength.
0	0	1.10	.....	= 22.0 per cent.

Elongation of inch sections: ".14, ".17, ".16, ".28, ".35\*.

Diameter at fracture, ".60. Area, .283 square inch.

Contraction of area, 43.4 per cent.

Fractured 1".3 from neck. Appearance, fibrous.

No. 4651.

Marks, C.R.

Diameter, ".798.

Sectional area, .50 square inch.

Expansion, ".0420 in 6 inches.

Estimated annealing temperature, 1115° Fahr.

Gauged length, 5".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inches.</i>	<i>Inch.</i>	Initial load.
500	1,000	0.	0.	
2,500	5,000	.0008	0.	
5,000	10,000	.0017	.....	
7,500	15,000	.0027	.....	
10,000	20,000	.0037	.0001	
12,500	25,000	.0046	.....	
15,000	30,000	.0057	.0008	
15,500	31,000	.0058	.....	
16,000	32,000	.0060	.....	
16,500	33,000	.0062	.....	
17,000	34,000	.0065	.....	
17,500	35,000	.0067	.0004	
18,000	36,000	.0070	.....	
18,500	37,000	.0074	.....	
19,000	38,000	.0077	.....	
19,200	38,400	.....	.....	
18,000	36,000	.0180	.....	
18,500	37,000	.0247	.....	
19,000	38,000	.0505	.....	
19,500	39,000	.0866	.....	
20,000	40,000	.1017	.0932	
20,500	41,000	.1120	.....	
21,000	42,000	.1212	.....	
21,500	43,000	.14	.....	
22,000	44,000	.19	.....	
22,500	45,000	.23	.....	
23,000	46,000	.26	.....	
23,500	47,000	.32	.....	
24,000	48,000	.38	.....	
24,500	49,000	.46	.....	
25,000	50,000	.61	.....	
25,320	50,640	.....	.....	
0	0	1.08	.....	

Elastic limit.  
Load fall.

Tensile strength.  
= 21.6 per cent.

Elongation of inch sections: ".11, ".15, ".18, ".40\*, ".24.  
 Diameter at fracture, ".60. Area, .283 square inch.  
 Contraction of area, 43.4 per cent.  
 Fractured 1".5 from neck. Appearance, fibrous.

No. 4652.

Marks, C R.

Diameter, ".798.

Sectional area, .50 square inch.

Expansion, ".0605 in 6 inches.

Estimated temperature, 1,575° Fahr.

Annealed at 1,050° Fahr. four hours, then cooled, and afterwards annealed at the estimated temperature of 1,575° Fahr.

Gauged length, 5'.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inches.</i>	<i>Inch.</i>	
500	1,000	0.	0.	Initial load.
2,500	5,000	.0007	0.	
5,000	10,000	.0017	-----	
7,500	15,000	.0025	-----	
10,000	20,000	.0035	.0001	
12,500	25,000	.0045	-----	
15,000	30,000	.0056	.0004	
15,500	31,000	.0059	-----	
16,000	32,000	.0061	-----	
16,500	33,000	.0063	-----	
17,000	34,000	.0066	-----	
17,500	35,000	.0068	.0006	
18,000	36,000	.0072	-----	
18,400	36,800	-----	-----	Elastic limit; load f.c.l.
17,000	34,000	.0114	-----	
17,500	35,000	.0161	-----	
18,000	36,000	.0330	-----	
18,500	37,000	.0530	-----	
19,000	38,000	.0750	-----	
19,500	39,000	.0905	-----	
20,000	40,000	.1080	.0095	Rested under this load 1 hour.
500	1,000	-----	-----	
20,500	41,000	.1104	-----	
21,000	42,000	.1435	-----	
21,500	43,000	.17	-----	
22,000	44,000	.19	-----	
22,500	45,000	.21	-----	
23,000	46,000	.26	-----	
23,500	47,000	.31	-----	
24,000	48,000	.36	-----	
24,500	49,000	.43	-----	
25,000	50,000	.53	-----	
25,420	50,840	-----	-----	Tensile strength.
0	0	1.11	-----	=22.2 per cent.

Elongation of inch sections; ".12, ".15, ".46\*, ".24, ".14.

Diameter at fracture, ".59. Area, .273 square inch.

Contraction of area, 45.4 per cent.

Fractured 2".84 from neck. Appearance, fibrous,

No. 4653.

Marks, C R.

Diameter, ".798.

Sectional area, .50 square inch.

Heated bright cherry red and cooled in the open air.

Expansion, ".103 in 9".05.

Estimated temperature, 1,768° Fahr.

Gauged length, 5".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inches.</i>	<i>Inch.</i>	
500	1,000	0.	0.	Initial load.
2,500	5,000	.0008	0.	
5,000	10,000	.0018	.0001	
7,500	15,000	.0029	.0003	
10,000	20,000	.0052	.0016	Elastic limit below 20,000 pounds.
10,500	21,000	.0057	.....	
11,000	22,000	.0062	.....	
11,500	23,000	.0077	.....	
12,000	24,000	.0162	.....	
12,500	25,000	.0296	.0253	
13,000	26,000	.0365	.....	
13,500	27,000	.0509	.....	
14,000	28,000	.0590	.....	
14,500	29,000	.0703	.....	
15,000	30,000	.0845	.0784	
15,500	31,000	.0936	.....	
16,000	32,000	.1075	.....	
16,500	33,000	.1245	.....	
17,000	34,000	.1389	.....	
17,500	35,000	.1591	.1520	
18,000	36,000	.1729	.....	
18,500	37,000	.1965	.....	
19,000	38,000	.21	.....	
19,500	39,000	.26	.....	
20,000	40,000	.27	.....	
20,500	41,000	.31	.....	
21,000	42,000	.33	.....	
21,500	43,000	.36	.....	
22,000	44,000	.42	.....	
22,500	45,000	.43	.....	
23,000	46,000	.52	.....	
23,500	47,000	.62	.....	
24,000	48,000	.80	.....	
24,470	48,940	1.16	.....	Tensile strength.
0	0	1.40	.....	= 28.0 per cent.

Elongation of inch sections: ".21, ".32, ".45\*, ".22, ".20.

Diameter at fracture, ".60. Area, .283 square inch.

Contraction of area, 43.4 per cent.

Fractured 2".8 from neck. Appearance, fibrous.



No. 4656.

Marks, C R.

Diameter, ".798.

Sectional area, .50 square inch.

Heated bright cherry red and quenched in brine.

Gauged length, 5".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	Pounds.	Inches.	Inch.	
500	1,000	0.	0.	Initial load.
2,500	5,000	.0008	0.	
5,000	10,000	.0024	-----	
7,500	15,000	.0043	.0014	
10,000	20,000	.0064	.0028	
10,500	21,000	.0068	-----	
11,000	22,000	.0072	-----	
11,500	23,000	.0078	-----	
12,000	24,000	.0086	-----	
12,500	25,000	.0094	.0047	
13,000	26,000	.0108	-----	
13,500	27,000	.0114	-----	
14,000	28,000	.0133	-----	
14,500	29,000	.0155	-----	
15,000	30,000	.0180	.0121	
15,500	31,000	.0220	-----	
16,000	32,000	.0275	-----	
16,500	33,000	.0360	-----	
17,000	34,000	.0415	-----	
17,500	35,000	.0541	.0460	
18,000	36,000	.0620	-----	
18,500	37,000	.0755	-----	
19,000	38,000	.0885	-----	
19,500	39,000	.0995	-----	
20,000	40,000	.1171	.1087	
20,500	41,000	.13	-----	
21,000	42,000	.14	-----	
21,500	43,000	.16	-----	
22,000	44,000	.20	-----	
22,500	45,000	.22	-----	
23,000	46,000	.26	-----	
23,500	47,000	.26+	-----	
24,000	48,000	.33	-----	
24,500	49,000	.33+	-----	
25,000	50,000	.42	-----	
25,000	51,000	.48	-----	
26,000	52,000	.59	-----	
26,500	53,000	.78	-----	
26,500	53,180	.91	-----	
0	0	1.08	-----	

Tensile strength.  
= 21.6 per cent.

Elongation of inch sections: ".12, ".16, ".20, ".42\*, ".18.

Diameter at fracture, ".63. Area, .312 square inch.

Contraction of area, 37.6 per cent.

Fractured 1".9 from neck. Appearance, fibrous; trace of granulation.

No. 4657.

Marks, C R.

Diameter, ".798.

Sectional area, .50 square inch.

Heated bright cherry red and quenched in oil.

Gauged length, 5".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inches.</i>	<i>Inch.</i>	Initial load.
500	1,000	0.	0.	
2,500	5,000	.0008	.0001	
5,000	10,000	.0020	.0004	
7,500	15,000	.0035	.0008	
10,000	20,000	.0055	.0018	
10,500	21,000	.0060	.....	
11,000	22,000	.0065	.....	
11,500	23,000	.0074	.....	
12,000	24,000	.0089	.....	
12,500	25,000	.0105	.0057	
13,000	26,000	.0159	.....	
13,500	27,000	.0230	.....	
14,000	28,000	.0315	.....	
14,500	29,000	.0409	.....	
15,000	30,000	.0483	.0404	
15,500	31,000	.0583	.....	
16,000	32,000	.0620	.....	
16,500	33,000	.0667	.....	
17,000	34,000	.1002	.....	
17,500	35,000	.1054	.0984	
18,000	36,000	.1214	.....	
18,500	37,000	.1389	.....	
19,000	38,000	.1559	.....	
19,500	39,000	.1590	.....	
20,000	40,000	.2024	.1946	
20,500	41,000	.22	.....	
21,000	42,000	.25	.....	
21,500	43,000	.28	.....	
22,000	44,000	.31	.....	
22,500	45,000	.32	.....	
23,000	46,000	.40	.....	
23,500	47,000	.43	.....	
24,000	48,000	.51	.....	
24,500	49,000	.59	.....	
25,000	50,000	.70	.....	
25,500	51,000	.97	.....	
25,710	51,420	.....	.....	Tensile strength.
0	0	1.29	.....	= 25.8 per cent.

Elongation of inch sections: ".24, ".44\*, ".18, ".21, ".22.

Diameter at fracture, ".60. Area, .283 square inch.

Contraction of area, 43.4 per cent.

Fractured 1".34 from neck. Appearance, fibrous,

TABLATION OF TENSION SPECIMENS FROM COLD ROLLED IRON SHAFT.

No. of test.	Estimated annealing temperature.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation in 5 inches.		Area at fracture.	Contraction of area.	Appearance of fracture.	Elongation of inch section.		Remarks.			
				Inches.	Per ct.				"	Per ct.				
4533	Not annealed	Pounds. 48,000	Pounds. 67,560	13.6	33.6	Diam. .65=.332	33.6	Fibrous.....	.11	.30*	.11	.09	.07	Elastic limit, approximate.
4539	.....do	47,000	67,320	.68	9.6	Diam. .65=.332	36.6	.....do	.04	.05	.06	.07	.29*	Do.
4540	.....do	46,000	66,000	.65	13.0	Diam. .65=.332	33.6	.....do	.08	.31*	.09	.09	.07	Annealed two hours.
4541	.....do	47,000	64,400	.78	15.6	Diam. .64=.322	35.6	.....do	.08	.14	.33*	.13	.08	Do.
4542	.....do	49,000	64,100	.67	13.4	Diam. .64=.322	35.6	.....do	.08	.30*	.13	.10	.08	Annealed two hours at 200° and one
4543	.....do	49,000	65,880	.71	14.2	Diam. .63=.312	37.6	.....do	.07	.10	.10	.20*	.24*	} and one-half hours at 300° Fahr.
4544	.....do	49,000	65,040	.72	14.4	Diam. .64=.322	35.6	.....do	.08	.15	.29*	.10	.10	
4545	.....do	49,000	63,940	.75	15.0	Diam. .63=.312	37.6	.....do	.08	.12	.32*	.14	.09	
4546	.....do	48,000	63,580	1.14	22.8	Diam. .60=.283	43.4	.....do	.21	.43*	.22	.17	.11	
4547	.....do	48,000	59,380	.74	14.6	Diam. .61=.292	41.6	.....do	.07	.18	.33*	.08	.06	
4548	.....do	48,000	58,000	.84	16.8	Diam. .60=.283	43.4	.....do	.09	.11	.12	.15	.19	
4549	.....do	41,000	55,400	.96	19.2	Diam. .61=.292	41.6	.....do	.10	.15	.16	.24	.35*	
4550	.....do	35,000	53,240	1.10	22.0	Diam. .60=.283	43.4	.....do	.14	.17	.18	.24	.34	
4551	.....do	38,000	50,640	1.08	21.6	Diam. .60=.283	43.4	.....do	.11	.15	.18	.40*	.24	
4552	.....do	36,800	50,840	1.11	22.2	Diam. .60=.283	43.4	.....do	.12	.15	.16*	.24	.14	Annealed four hours at 1,050° then cooled and annealed at 1,575° Fahr.
4553	.....do	*20,000	48,940	1.40	28.0	Diam. .60=.283	43.4	.....do	.21	.32	.45*	.22	.20	Heated bright cherry red and quenched in brine.
4556	.....do	*20,000	53,180	1.08	21.6	Diam. .63=.312	37.6	Fibrous, trace of granulation.	.12	.16	.20	.42*	.18	Heated bright cherry red and quenched in oil.
4557	.....do	*20,000	51,420	1.29	25.8	Diam. .60=.283	43.4	Fibrous.....	.24	.44*	.18	.21	.22	

\* Below.



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## TEMPERATURE BARS.

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TENSILE TESTS OF SPECIMENS BELONGING TO THE  
SECOND SERIES OF TEMPERATURE TEST BARS.

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No. 4568.

STEEL BAR.

Mark, 12.

Diameter, ".564.

Sectional area, .25 square inch.

Gauged length, 6".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
250	1,000	0.	0.	
1,250	5,000	.0007	0.	
2,500	10,000	.0017	.....	
3,750	15,000	.0027	.....	
5,000	20,000	.0037	.0	
6,250	25,000	.0049	.....	
7,500	30,000	.0059	.0	
8,750	35,000	.0068	.....	
10,000	40,000	.0079	.0001	
11,250	45,000	.0088	.....	
12,500	50,000	.0100	.0001	
13,750	55,000	.0110	.....	
15,000	60,000	.0121	.0001	
15,250	61,000	.0122	.....	
15,500	62,000	.0124	.....	
15,750	63,000	.0127	.....	
16,000	64,000	.0129	.....	
16,250	65,000	.0132	.0001	
16,500	66,000	.0134	.....	
16,750	67,000	.0137	.....	
17,000	68,000	.0139	.....	
17,250	69,000	.0141	.....	
17,500	70,000	.0143	.0001	
17,750	71,000	.0146	.....	
18,000	72,000	.0150	.....	
18,250	73,000	.0157	.....	
18,500	74,000	.0300	.....	
18,750	75,000	.0401	.....	
19,000	76,000	.0438	.....	
19,500	78,000	.0462	.....	
20,000	80,000	.0538	.....	
20,500	82,000	.0610	.0410	
21,000	84,000	.0670	.....	
21,500	86,000	.0737	.....	
22,000	88,000	.0804	.....	
22,500	90,000	.0891	.....	
23,000	94,000	.0968	.....	
23,500	94,000	.115	.....	
25,000	100,000	.135	.....	
25,500	102,000	.145	.....	
26,000	104,000	.160	.....	
26,500	106,000	.170	.....	
27,000	108,000	.185	.....	
27,500	110,000	.205	.....	
28,000	112,000	.220	.....	
28,500	114,000	.230	.....	
29,000	116,000	.245	.....	
29,500	118,000	.26	.....	
30,000	120,000	.28	.....	
30,500	122,000	.30	.....	
31,000	124,000	.33	.....	
31,500	126,000	.38	.....	
32,000	128,000	.43	.....	
32,500	130,000	.53	.....	
32,870	131,480	.71	.....	
0	0	.88	.....	
				Tensile strength. =14.7 per cent.

Elongation of inch sections: ".11, ".14, ".15, ".25\*, ".12, ".11.

Diameter at fracture, ".47. Area, .174 square inch.

Contraction of area, 30.4 per cent.

Fractured 3" from neck. Appearance, fine granular, dull center.

No. 4569.

## STEEL BAR.

Mark, 15.

Diameter, ".564.

Sectional area, .25 square inch.

Gauged length, 6".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
250	1,000	0.	0.	
1,250	5,000	.0008	0.	
2,500	10,000	.0018	0.	
5,000	20,000	.0039	0.	
7,500	30,000	.0059	0.	
8,750	35,000	.0069	0.	
10,000	40,000	.0081	0.	
11,250	45,000	.0090	0.	
12,500	50,000	.0102	0.	
13,750	55,000	.0113	0.	
15,000	60,000	.0124	.0001	
16,250	65,000	.0134	.0001	
17,000	68,000	.0143	0.	
17,250	69,000	.0149	0.	
17,500	70,000	.0172	.0028	
17,750	71,000	.0338	0.	
18,000	72,000	.0360	0.	
18,250	73,000	.0371	0.	
18,500	74,000	.0410	0.	
19,000	76,000	.0455	0.	
19,500	78,000	.0517	0.	
20,000	80,000	.0585	.0378	
20,500	82,000	.0652	0.	
21,000	84,000	.0688	0.	
21,500	86,000	.0756	0.	
22,000	88,000	.0822	0.	
22,500	90,000	.0898	0.	
23,000	92,000	.0955	0.	
23,500	94,000	.1025	0.	
24,000	96,000	.1100	0.	
25,000	100,000	.13	0.	
26,000	104,000	.15	0.	
27,000	108,000	.17	0.	
28,000	112,000	.19	0.	
29,000	116,000	.21	0.	
30,000	120,000	.24	0.	
31,000	124,000	.28	0.	
32,000	128,000	.32	0.	
33,000	132,000	.41	0.	
33,500	134,000	.50	0.	
33,800	135,440	.61	0.	
0	0	.70	0.	

Elastic limit.

Tensile strength.  
= 11.7 per cent.

Elongation of inch sections: ".08, ".10, ".19\*, ".14, ".10, ".09.

Diameter at fracture, ".48. Area, .181 square inch.

Contraction of area, 27.6 per cent.

Fractured at the middle of stem. Appearance, fine granular, dull center.



No. 4570.

STEEL BAR.

Mark, 18.  
 Diameter, ".564.  
 Sectional area, .25 square inch.  
 Gauged length, 6".

Applied loads.		In gauged length.		Remarks.	
Total.	Per square inch.	Elongation.	Set.		
Pounds.	Pounds.	Inch.	Inch.		
250	1,000	0.	0.	Initial load.	
1,250	5,000	.0008	0.		
2,500	10,000	.0018	-----		
5,000	20,000	.0036	-----		
7,500	30,000	.0056	-----		
10,000	40,000	.0078	0.		
11,250	45,000	.0088	-----		
12,500	50,000	.0098	-----		
13,750	55,000	.0109	-----		
15,000	60,000	.0121	.0001		
15,500	62,000	.0127	-----		
16,000	64,000	.0132	-----		Elastic limit.
16,250	65,000	.0340	-----		
16,500	66,000	.0398	.0223		
17,000	68,000	.0433	-----		
17,500	70,000	.0465	-----		
18,000	72,000	.0508	.0317		
18,500	74,000	.0578	-----		
19,000	76,000	.0617	-----		
19,500	78,000	.0654	-----		
20,000	80,000	.0715	.0531		
21,000	84,000	.0765	-----		
22,000	88,000	.08	-----		
23,000	92,000	.09	-----		
24,000	96,000	.11	-----		
25,000	100,000	.14	-----		
26,000	104,000	.16	-----		
27,000	108,000	.17	-----		
28,000	112,000	.19	-----		
29,000	116,000	.21	-----		
30,000	120,000	.24	-----		
31,000	124,000	.26	-----		
32,000	128,000	.31	-----		
32,920	131,680	.37	-----	Tensile strength. = 9.5 per cent.	
0	0	.57	-----		

Elongation of inch sections: ".10, ".10, ".09, ".10, ".09, ".09.  
 Diameter at fracture, ".52. Area, ".212 square inch.  
 Contraction of area, 15.2 per cent.  
 Fractured 1".10 from neck. Appearance, fine granular, radiating from center punch mark.



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# ENDURANCE OF ROTATING SHAFTS

FROM

STEEL, WROUGHT IRON, AND CAST IRON BARS.

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## ENDURANCE OF ROTATING SHAFTS.

The tests of rotating shafts for endurance under transverse stresses are continued from previous years.

Steel bars marked 15, 20, and 21 were from the second lot of steel for temperature tests. Steel bars marked S 8 were from the eighth rod of a lot of steel, specimens from seven rods having been tested and included in Report of 1890.

The test of cast iron bar No. 30 has been completed. This remarkable specimen made 47,283,500 rotations before rupture, and it appears that each rotation was accompanied by a decided permanent set in the metal.

Tension tests were made from a number of shafts to show the relation between the transverse stresses which ultimately caused rupture, and the tensile properties of the metal.

In order to obtain further data upon the phases of deterioration which the metal undergoes when subjected to alternate repeated stresses, the rotating tests of certain shafts were discontinued before rupture occurred, and from these shafts specimens were taken and tested by tension.

Inasmuch as the maximum stresses are confined to the exterior metal at the middle of the length of the shaft where the loads were applied, it was decided to test annular specimens taken from this middle section in comparison with specimens of similar form taken from the outer end of the shaft, where the metal in the latter case had not been exposed to excessive bending stresses.

A comparison was made between annular and solid specimens from a steel bar 1" diameter, which indicated that nearly the same strength was shown by the two types of specimens. The result of these two tests precede the regular tests of the endurance series.

In the annular specimens from the middle of the endurance shafts it was of course intended to test only the metal which had been exposed to nearly or quite the maximum stresses. The specimens were consequently bored out, leaving a thickness of only one-sixteenth of an inch of metal.

The results were as follows:

### SHAFTS FROM STEEL BAR No. 8.

Endurance record.			Tensile strength per square inch of annular specimens from—				Remarks.	
Number.	Fiber stress per square inch.	Number of rotations.	Middle of shaft.	End of shaft.	Gain or loss of middle specimen.			
					Gain.	Loss.		
	Pounds. 30,000 and 40,000		Pounds.	Pounds.	Pounds.	Pounds.		
130	{ 30,000 and 40,000 }	173,400	-----	-----	-----	-----	{ Endurance shaft ruptured. }	
131		100,000	67,070	64,240	2,830	-----		
132		40,000	87,900	67,070	61,000	6,070		-----
133		40,000	60,000	91,630	60,770	30,860		-----
134		40,000	124,000	64,620	61,120	3,500		-----

## COLD ROLLED IRON SHAFTS.

Endurance record.			Tensile strength per square inch of annular specimens from—				Remarks.
Number.	Fiber stress per square inch.	Number of rotations.	Middle of shaft.	End of shaft.	Gain or loss of middle specimen.		
					Gain.	Loss.	
	Pounds.		Pounds.	Pounds.	Pounds.	Pounds.	
137	40,000	325,300					Endurance shaft ruptured.
138	40,000	250,000	53,750	73,420		19,670	
139	40,000	150,000	62,810	72,390		9,780	Endurance shafts ruptured.
140	45,000	192,500					
141	45,000	118,500					Endurance shaft ruptured.
142	45,000	125,000	34,620	69,620		35,000	
143	45,000	80,000	57,720	71,960		14,240	Endurance shaft ruptured.
144	45,000	40,000	70,540	68,640	1,900		
145	50,000	47,050					Endurance shaft ruptured.
146	50,000	40,000	58,000	66,850		10,850	
147	50,000	20,000	65,430	68,000		2,570	Endurance shaft ruptured.
148	50,000	5,000	61,000	64,000		3,000	

In the case of the steel bar tested by repeated stresses, 40,000 pounds per square inch fiber stress ultimately caused rupture.

The annular tensile specimens taken from the other endurance shafts not carried to rupture in the rotating tests, show the metal stronger in each instance at the middle over the end specimens.

In this behavior we note a similarity in effect to that of other cold working, in raising the tensile strength at least for a time, and it suggests the probability that metal generally passes through a stage of increased tensile resistance before its final rupture under apparently diminished loads; or, stated in another manner, that ordinary hot worked metal is not left in its state of greatest tensile resistance, and that while repeated alternate stresses below the ordinarily accepted tensile strength eventually causes rupture, the metal at an intermediate stage passes through a state of increased resistance.

We are not certain when final rupture occurs that the parts first to rupture are not at the time in a state of maximum resistance, and the apparent loss in strength may be due to the accumulation of internal strains or some other cause not yet recognized.

The cold rolled iron annular specimens, with one exception, showed lower strength at the middle than the end specimens.

While the data are insufficient to explain conclusively these results, yet they are suggestive, and lead to the conjecture that as we have in the cold rolled iron the metal already in a state of increased resistance, approaching the maximum, additional working under repeated stresses would tend to lower its apparent strength.

The total number of rotations necessary to cause rupture differs widely in specimens nominally of the same grade of metal exposed to similar conditions of loading.

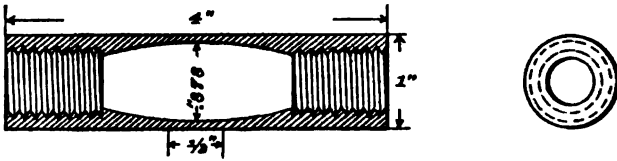
For further investigation of these phenomena it is purposed to continue the test with annular specimens from shafts exposed to different fiber stresses and after different periods of rotation, establishing more points in the curve of apparent strength as modified by total fiber stress and repetitions of load.

Also to anneal and then test other annular specimens from overloaded shafts, to determine the question of permanency in the modified strength of the metal. These tests, it is believed, will furnish data upon the influence of accumulated internal strains in promoting rupture, and data relating to the complete or partial effacement of the effects of overstraining at different stages prior to complete rupture.



No. 4734.

ANNULAR SPECIMEN.



Sectional area, .180 square inch.  
Gauged length, 3''.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
180	1,000	0.	0.	
900	5,000	.0001	.....	
1,800	10,000	.0003	.....	
3,600	20,000	.0012	— .0001	
4,500	25,000	.0018	.....	
5,400	30,000	.0023	— .0001	
6,300	35,000	.0029	.....	
7,200	40,000	.0040	.0005	
7,380	41,000	.0138	.....	
7,560	42,000	.0221	.....	
7,740	43,000	.0279	.....	
7,920	44,000	.0520	.....	
8,100	45,800	.0643	.....	
8,280	46,000	.0700	.....	
8,460	47,000	.0748	.....	
8,640	48,000	.0820	.....	
8,820	49,000	.0905	.....	
9,000	50,000	.0995	.....	
10,980	61,000	.....	.....	Tensile strength.

Appearance of fracture, silky.



No. 122.

STEEL BAR. MARKS, 15.

Diameter, 1". Speed of rotation, 400 per minute. Length between end bearings, 33". Deflections measured on chord of 10".

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.					Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Loaded.		Unloaded.				
			Inch.	Inch.	Inch.	Inch.	Inch.			
40,000	0	0	a	.2002	.1700	.2002	.0802	Inch. 0. .0802 0. .0001		
			b	.2005	.1703	.2005	.0802			
			c	.2004	.1701	.2008	.0802			
10,000	10,000	10,000	a	.2002	.1701	.2002	.0801	0. 0. .0001		
			b	.2005	.1703	.2005	.0802			
			c	.2004	.1702	.2003	.0801			
40,000	40,000	50,000	a	.2002	.1702	.2002	.0800	0. 0. 0.		
			b	.2005	.1703	.2005	.0802			
			c	.2003	.1701	.2003	.0802			
50,000	50,000	100,000	a	.2003	.1703	.2003	.0799	.0001 .0001 .0001		
			b	.2005	.1702	.2004	.0802			
			c	.2004	.1701	.2003	.0802			
100,000	100,000	200,000	a	.2003	.1700	.2002	.0802	.0001 .0001 .0001		
			b	.2005	.1702	.2004	.0802			
			c	.2004	.1701	.2003	.0802			
100,000	100,000	300,000	a	.2003	.1699	.2002	.0803	.0001 0. 0.		
			b	.2005	.1702	.2005	.0803			
			c	.2004	.1700	.2004	.0804			
205,000	205,000	505,000	a	.2003	.1698	.2002	.0804	.0001 .0001 .0001		
			b	.2005	.1701	.2004	.0803			
			c	.2003	.1699	.2003	.0804			
195,000	195,000	700,000	a	.2002	.1700	.2002	.0802	0. 0. .0001		
			b	.2005	.1702	.2005	.0803			
			c	.2004	.1700	.2008	.0803			

No. 122—Continued.

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.			Deflections.	Sets.	Remarks.	
	Successive.	Total.	On line.	Unloaded.	Loaded.				Unloaded.
Pounds.	300,000	1,000,000	a	Inch. .2002	Inch. .1688	Inch. .0304	0.		
			b	.2005	.1702	.0308			0.
			c	.2008	.1700	.0303			0.
1,000,000	2,000,000	a	.2003	.1702	.0300	.0001			
		b	.2006	.1702	.0303			.0001	
		c	.2004	.1702	.0302			0.	
1,002,000	3,002,000	a	.2002	.1688	.0304	0.			
		b	.2005	.1701	.0304			0.	
		c	.2004	.1699	.0305			0.	
1,006,000	4,008,000	a	.2001	.1687	.0304	0.			
		b	.2005	.1702	.0303			0.	
		c	.2002	.1702	.0300			0.	
992,000	5,000,000	a	.2003	.1699	.0304	0.			
		b	.2006	.1702	.0304			0.	
		c	.2005	.1701	.0303			0.	
1,005,500	6,005,500	a	.2004	.1703	.0301	0.			
		b	.2007	.1704	.0302			.0001	
		c	.2005	.1701	.0303			.0001	
570,900	570,900	6,576,400						Bar ruptured.	

No. 121.

STEEL BAR. MARKS, 20.

Diameter, 1". Speed of rotation, 400 per minute. Length between end bearings, 33". Deflections measured on chord of 10".

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds. 40,000	0	0		Inch. .1990 .1990 .1994	Inch. .1695 .1695 .1699	Inch. .1990 .1990 .1992	Inch. .0295 .0295 .0298	0 0 .0002	
	10,000	10,000	a b c	.1996 .1992 .1996	.1690 .1698 .1696	.1996 .1987 .1989	.0296 .0294 .0293	0 .0005 .0006	
	146,700	186,700	a b c	.1985 .2001 .2010	.1685 .1677 .1681	.1985 .1978 .1982	.0300 .0301 .0301	0 .0023 .0028	
243,940	585,640	a b c	.2013 .1983 .1987	.1696 .1672 .1680	.1994 .1973 .1981	.0298 .0301 .0301	.0019 .0009 .0016		
340,560	845,200							Bar ruptured.	

No. 120.

STEEL BAR. MARKS, 21.

Diameter, 1". Speed of rotation, 400 per minute. Length between end bearings, 33". Deflections measured on chord of 10".

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.			
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.						
Pounds. 40,000	0	0		Inch. .2006 .2005 .2011	Inch. .1709 .1711 .1714	Inch. .2004 .2008 .2010	Inch. .0285 .0286 .0286	Inch. .0002 .0002 .0001				
			10,000	10,000		.2004 .2012 .2013	.1704 .1707 .1707			.2002 .2004 .2006	.0288 .0297 .0299	.0002 .0006 .0007
					40,000	50,000				.2008 .2025 .2018	.1685 .1688 .1689	.1990 .1995 .1995
	150,000	260,000						.1972 .2010 .2039	.1659 .1688 .1677	.1970 .1980 .1989	.0312 .0312 .0312	.0002 .0030 .0050
			300,000	500,000				.2014 .2035 .2027	.1684 .1670 .1673	.1978 .1985 .1988	.0314 .0315 .0312	.0036 .0050 .0043
					.....							Bar ruptured.
	.....							Bar ruptured.				

Bar acquired temperature of about 110° Fahr. while running.

Bar ruptured.

No. 130.

STEEL BAR. MARKS, S 8.

Diameter, 1". Speed of rotation, 400 per minute. Length between end bearings, 33". Deflections measured on chord of 10".

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
30,000	0	0	c	.1997	.1777	.1996	.0219	.0001	
			b	.1997	.1776	.1996	.0220	.0001	
			c	.1997	.1776	.1997	.0221	0	
35,000	12,000	12,000	c	.1993	.1769	.1963	.0224	0	
			b	.1998	.1778	.1969	.0220	0	
			c	.1997	.1773	.1964	.0221	.0003	
40,000	0	12,000	c	.1994	.1734	.1963	.0259	.0001	
			b	.1998	.1743	.1967	.0254	.0001	
			c	.1994	.1737	.1963	.0256	.0001	
40,000	28,000	40,000	c	.1989	.1729	.1963	.0259	.0001	
			b	.2002	.1738	.1967	.0259	.0005	
			c	.1996	.1733	.1963	.0260	.0003	
40,000	0	40,000	c	.1995	.1693	.1939	.0296	.0006	
			b	.2003	.1702	.1966	.0294	.0007	
			c	.1968	.1697	.1839	.0292	.0004	
40,000	22,000	63,000	c	.2007	.1635	.1933	.0298	.0024	
			b	.2006	.1633	.1962	.0299	.0014	
			c	.2002	.1633	.1933	.0299	.0020	
	110,400	173,466						Bar ruptured.	

## No. 131.

## STEEL BAR. MARKS S 8.

Diameter, 1". Speed of rotation, 400 per minute. Length between end bearings, 33". Deflections measured on chord of 10".

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.						Deflections.	Sets.	Remarks.		
	Successive.	Total.	On line.		Loaded.		Unloaded.						
			Unloaded.	Loaded.	Unloaded.	Loaded.	Unloaded.	Loaded.					
Pounds. 40,000	0	0	a	Inch. .1997	Inch. .1890	Inch. .1887	Inch. .0297	Inch. .0010	Inch. .0006	0	Test discontinued.		
			b	.1993	.1891	.1887						.0296	.0006
			c	.2004	.1706	.2002						.0296	.0002
100,000	100,000	a	.1832	.1833	.1833	.0300	.0019	.0006	0	0	Test discontinued.		
		b	.2013	.1896	.1994	.0298	.0019						
		c	.2033	.1717	.2013	.0296	.0020						

## No. 132.

## STEEL BAR. MARKS, S 8.

Diameter, 1". Speed of rotation, 400 per minute. Length between end bearings, 33". Deflections measured on chord of 10".

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.						Deflections.	Sets.	Remarks.			
	Successive.	Total.	On line.		Loaded.		Unloaded.							
			Unloaded.	Loaded.	Unloaded.	Loaded.	Unloaded.	Loaded.						
Pounds. 40,000	0	0	a	Inch. .1994	Inch. .1702	Inch. .1997	Inch. .0295	Inch. —	Inch. .0001	—	0	Test discontinued.		
			b	.2002	.1705	.1996							.0293	.0004
			c	.1993	.1899	.1992							.0293	.0001
87,000	87,000	a	.1988	.1982	.1985	.0303	.0001	.0001	0	0	Test discontinued.			
		b	.2011	.1887	.1986	.0302	.0022							
		c	1.986	.1889	.1986	.0297	.0022							

No. 133.

STEEL BAR. MARKS, S 8.

Diameter, 1". Speed of rotation, 400 per minute. Length between end bearings, 33". Deflections measured on chord of 10".

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Loaded.		Unloaded.			
				Inch.	Inch.				
Pounds. 40,000	0	0	a	.1991	.1998	.1990	.0234	Inch. .0001	
			b	.1995	.1993	.1993	.0238	.0002	
			c	.1997	.1700	.1996	.0296	.0001	
60,000	60,000	60,000	a	.1977	.1875	.1975	.0300	.0053	Test discontinued.
			b	.2009	.1690	.1947	.0307	.0023	
			c	.2005	.1686	.1983	.0289	.0020	

No. 134.

STEEL BAR. MARKS, S 8.

Diameter, 1". Speed of rotation, 400 per minute. Length between end bearings, 33". Deflections measured on chord of 10".

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Loaded.		Unloaded.			
				Inch.	Inch.				
Pounds. 40,000	0	0	a	.2001	.1999	.1999	.0300	Inch. .0002	
			b	.2000	.1700	.1999	.0299	.0001	
			c	.2001	.1700	.1999	.0299	.0002	
124,000	124,000	124,000	a	.2000	.1991	.1989	.0288	.0011	Test discontinued.
			b	.1994	.1684	.1984	.0300	.0010	
			c	.2015	.1689	.1991	.0302	.0024	

No. 131.

STEEL BAR. MARKS S 8.

Diameter, 1". Speed of rotation, 400 per minute. Length between end bearings, 33". Deflections measured at 10".

Maximum fiber stress per square inch	Number of rotations.	Micrometer readings	
		Unloaded	Loaded
	0	0.000	0.000
	100	0.000	0.000
	200	0.000	0.000
	300	0.000	0.000
	400	0.000	0.000
	500	0.000	0.000
	600	0.000	0.000
	700	0.000	0.000
	800	0.000	0.000
	900	0.000	0.000
	1000	0.000	0.000
	1100	0.000	0.000
	1200	0.000	0.000
	1300	0.000	0.000
	1400	0.000	0.000
	1500	0.000	0.000
	1600	0.000	0.000
	1700	0.000	0.000
	1800	0.000	0.000
	1900	0.000	0.000
	2000	0.000	0.000
	2100	0.000	0.000
	2200	0.000	0.000
	2300	0.000	0.000
	2400	0.000	0.000
	2500	0.000	0.000
	2600	0.000	0.000
	2700	0.000	0.000
	2800	0.000	0.000
	2900	0.000	0.000
	3000	0.000	0.000
	3100	0.000	0.000
	3200	0.000	0.000
	3300	0.000	0.000
	3400	0.000	0.000
	3500	0.000	0.000
	3600	0.000	0.000
	3700	0.000	0.000
	3800	0.000	0.000
	3900	0.000	0.000
	4000	0.000	0.000
	4100	0.000	0.000
	4200	0.000	0.000
	4300	0.000	0.000
	4400	0.000	0.000
	4500	0.000	0.000
	4600	0.000	0.000
	4700	0.000	0.000
	4800	0.000	0.000
	4900	0.000	0.000
	5000	0.000	0.000

No. 131.

Steel bar with worm drive No. 1

Speed of rotation, 400 per minute. Length between end bearings, 33".

Maximum fiber stress per square inch	Number of rotations.	Micrometer readings for deflections		Deflections
		Unloaded	Loaded	
	0	0.000	0.000	0.000
	100	0.000	0.000	0.000
	200	0.000	0.000	0.000
	300	0.000	0.000	0.000
	400	0.000	0.000	0.000
	500	0.000	0.000	0.000
	600	0.000	0.000	0.000
	700	0.000	0.000	0.000
	800	0.000	0.000	0.000
	900	0.000	0.000	0.000
	1000	0.000	0.000	0.000
	1100	0.000	0.000	0.000
	1200	0.000	0.000	0.000
	1300	0.000	0.000	0.000
	1400	0.000	0.000	0.000
	1500	0.000	0.000	0.000
	1600	0.000	0.000	0.000
	1700	0.000	0.000	0.000
	1800	0.000	0.000	0.000
	1900	0.000	0.000	0.000
	2000	0.000	0.000	0.000
	2100	0.000	0.000	0.000
	2200	0.000	0.000	0.000
	2300	0.000	0.000	0.000
	2400	0.000	0.000	0.000
	2500	0.000	0.000	0.000
	2600	0.000	0.000	0.000
	2700	0.000	0.000	0.000
	2800	0.000	0.000	0.000
	2900	0.000	0.000	0.000
	3000	0.000	0.000	0.000
	3100	0.000	0.000	0.000
	3200	0.000	0.000	0.000
	3300	0.000	0.000	0.000
	3400	0.000	0.000	0.000
	3500	0.000	0.000	0.000
	3600	0.000	0.000	0.000
	3700	0.000	0.000	0.000
	3800	0.000	0.000	0.000
	3900	0.000	0.000	0.000
	4000	0.000	0.000	0.000
	4100	0.000	0.000	0.000
	4200	0.000	0.000	0.000
	4300	0.000	0.000	0.000
	4400	0.000	0.000	0.000
	4500	0.000	0.000	0.000
	4600	0.000	0.000	0.000
	4700	0.000	0.000	0.000
	4800	0.000	0.000	0.000
	4900	0.000	0.000	0.000
	5000	0.000	0.000	0.000

Measured at middle bearing. Bar ruptured



No. 124.

COLD ROLLED IRON BAR. No. 1.

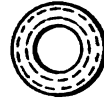
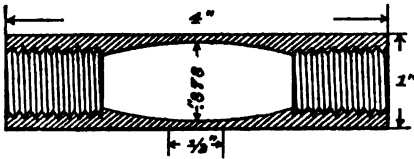
Diameter, 1". Speed of rotation, 400 per minute. Length between end bearings, 33". Deflections measured on chord of 10".

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.	
	Successive.	Total.	On line.	Unloaded.		Loaded.				
				Unloaded.	Unloaded.					
Pounds. 40,000	0	0	a	Inch. .2002	Inch. .1881	Inch. .1999	Inch. .0318	Inch. .0003		
			b	.2002	.1883	.1999	.0316			.0003
			c	.1997	.1876	.1993	.0317			.0004
	10,000	10,000	a	.2003	.1880	.1998	.0318	.0005		
			b	.2003	.1882	.1999	.0317	.0004		
			c	.1996	.1875	.1993	.0318	.0003		
	40,000	40,000	a	.2004	.1882	.1999	.0317	.0005		
			b	.2003	.1883	.1998	.0316	.0005		
			c	.1995	.1872	.1991	.0319	.0004		
	50,000 100,000 193,800	100,000 293,800	.....	.....	.....	.....	.....	.....		.....
			.....	.....	.....	.....	.....	.....		.....
			.....	.....	.....	.....	.....	.....		.....

Scored at middle bearing.  
Bar ruptured.

No. 4734.

ANNULAR SPECIMEN.



Sectional area, .180 square inch.  
Gauged length, 3/8''.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
180	1,000	0.	0.	
900	5,000	.0001	.....	
1,800	10,000	.0003	.....	
3,600	20,000	.0012	— .0001	
4,500	25,000	.0018	.....	
5,400	30,000	.0023	— .0001	
6,300	35,000	.0029	.....	
7,200	40,000	.0040	.0005	
7,380	41,000	.0138	.....	
7,560	42,000	.0221	.....	
7,740	43,000	.0279	.....	
7,920	44,000	.0520	.....	
8,100	45,000	.0643	.....	
8,280	46,000	.0700	.....	
8,460	47,000	.0748	.....	
8,640	48,000	.0820	.....	
8,820	49,000	.0905	.....	
9,000	50,000	.0985	.....	
10,980	61,000	.....	.....	Tensile strength.

Appearance of fracture, silky.

No. 122.

STEEL BAR. MARKS, 15.

Diameter, 1". Speed of rotation, 400 per minute. Length between end bearings, 33". Deflections measured on chord of 10".

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Loaded.		Unloaded.			
				Inch.	Inch.				
40,000	0	0	a	.1700	.2002	.2002	.0802	Inch. 0. 0. .0001	
			b	.1708	.2005	.2005	.0802		
			c	.1701	.2004	.2008	.0802		
10,000	10,000	10,000	a	.1701	.2002	.2002	.0801	0. 0. .0001	
			b	.1708	.2005	.2005	.0802		
			c	.1702	.2004	.2003	.0801		
40,000	40,000	50,000	a	.1702	.2002	.2002	.0800	0. 0. .0001	
			b	.1708	.2005	.2005	.0802		
			c	.1701	.2003	.2003	.0802		
50,000	50,000	100,000	a	.1708	.2003	.2002	.0800	.0299 0. .0001	
			b	.1702	.2005	.2004	.0802		
			c	.1701	.2004	.2003	.0802		
100,000	100,000	200,000	a	.1700	.2003	.2002	.0802	.0001 0. .0001	
			b	.1702	.2005	.2004	.0802		
			c	.1701	.2004	.2008	.0802		
100,000	100,000	300,000	a	.1699	.2003	.2002	.0808	.0001 0. .0001	
			b	.1702	.2005	.2005	.0803		
			c	.1700	.2004	.2004	.0804		
205,000	205,000	505,000	a	.1688	.2003	.2002	.0804	.0001 0. .0001	
			b	.1701	.2005	.2004	.0803		
			c	.1699	.2003	.2008	.0804		
185,000	185,000	700,000	a	.1700	.2002	.2002	.0802	0. 0. .0001	
			b	.1702	.2005	.2005	.0803		
			c	.1700	.2004	.2009	.0803		

No. 122—Continued.

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Setts.	Deflections.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.	800, 000	1, 000, 000	a	Inch. .2002	Inch. .1668	Inch. .2002	Inch. .0304	Inch. 0.	
			b	.2005	.1702	.2005	.0303	0.	
			c	.2008	.1700	.2008	.0303	0.	
1, 000, 000	2, 000, 000	a	.2008	.1702	.2002	.0300	.0001		
		b	.2006	.1702	.2005	.0303	.0001		
		c	.2004	.1702	.2004	.0302	0.		
1, 002, 000	3, 002, 000	a	.2002	.1688	.2002	.0304	0.		
		b	.2005	.1701	.2005	.0304	0.		
		c	.2004	.1689	.2004	.0305	0.		
1, 006, 000	4, 008, 000	a	.2001	.1687	.2001	.0304	0.		
		b	.2005	.1702	.2005	.0303	0.		
		c	.2002	.1702	.2002	.0300	0.		
982, 000	5, 000, 000	a	.2003	.1689	.2003	.0304	0.		
		b	.2006	.1702	.2006	.0304	0.		
		c	.2005	.1701	.2004	.0303	.0001		
1, 005, 500	6, 005, 500	a	.2004	.1708	.2004	.0301	0.		
		b	.2007	.1704	.2006	.0302	.0001		
		c	.2005	.1701	.2004	.0303	.0001		
		570, 900						Bar ruptured.	

No. 121.

STEEL BAR. MARKS, 20.

Diameter, 1". Speed of rotation, 400 per minute. Length between end bearings, 33". Deflections measured on chord of 10".

Pounds. 40,000	Number of rotations.		Micrometer readings for deflections.				Deflections. Inch.	Sets.	Remarks.	
	Successive.	Total.	On line.		Loaded.	Unloaded.				
			Unloaded.	Unloaded.						
0	0	0	a	.1990	.1695	.1990	.0295	Inch. 0 0 .0002		
			b	.1990	.1695	.1990	.0295			
			c	.1994	.1699	.1992	.0298			
10,000	10,000	10,000	a	.1986	.1690	.1986	.0296	0 0 .0006		
			b	.1992	.1693	.1987	.0294			
			c	.1996	.1696	.1989	.0293			
144,700	144,700	144,700	a	.1985	.1685	.1985	.0300	0 0 .0023		
			b	.2001	.1677	.1978	.0301			
			c	.2010	.1681	.1983	.0301			
248,940	248,940	248,940	a	.2013	.1696	.2013	.0298	.0019 .0009 .0016		
			b	.1983	.1673	.1973	.0301			
			c	.1997	.1680	.1981	.0301			
340,560	340,560	340,560	.....				Bar ruptured.			



No. 130.

STEEL BAR. MARKS, S 8.

Diameter, 1". Speed of rotation, 400 per minute. Length between end bearings, 33". Deflections measured on chord of 10".

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Loaded.		Unloaded.			
				Inch.	Inch.				
30,000	0	0	a	.1977	.1777	.1966	.0219	.0001	
			b	.1997	.1776	.1966	.0220	.0001	
			c	.1997	.1776	.1967	.0221	0	
35,000	12,000	12,000	a	.1963	.1769	.1963	.0224	0	
			b	.1968	.1778	.1968	.0220	0	
			c	.1997	.1773	.1964	.0221	.0003	
40,000	0	12,000	a	.1964	.1734	.1963	.0259	.0001	
			b	.1968	.1743	.1967	.0254	.0001	
			c	.1964	.1737	.1963	.0256	.0001	
40,000	28,000	40,000	a	.1939	.1729	.1963	.0259	.0001	
			b	.2002	.1738	.1967	.0259	.0005	
			c	.1966	.1733	.1963	.0260	.0003	
40,000	0	40,000	a	.1965	.1693	.1969	.0296	.0006	
			b	.2003	.1702	.1966	.0294	.0007	
			c	.1968	.1697	.1969	.0292	.0004	
40,000	28,000	68,000	a	.2007	.1685	.1963	.0298	.0024	Bar ruptured.
			b	.2006	.1693	.1962	.0298	.0014	
			c	.2002	.1683	.1963	.0299	.0020	
	110,400	173,466							

No. 131.

STEEL BAR. MARKS S 8.

Diameter, 1". Speed of rotation, 400 per minute. Length between end bearings, 33". Deflections measured on chord of 10".

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.						Deflections.	Sets.	Remarks.
	Successful.	Total.	On line.		Loaded.		Unloaded.				
			Inch.	Inch.	Inch.	Inch.	Inch.	Inch.			
Pounds. 40,000	0	0	a	.1997	.1890	.1897	.0297	.0010	Inch. .0297 .0010 .0006 .0002 0 .0019 .0020	0	Test discontinued.
			b	.1993	.1881	.1987	.0296	.0006			
			c	.2004	.1768	.2002	.0296	.0002			
100,000	100,000	a	.1932	.1832	.1832	.0300	.0019	Inch. .0300 .0298 .0296	0	Test discontinued.	
		b	.2013	.1896	.1994	.0298	.0019				
		c	.2033	.1717	.2013	.0296	.0020				

No. 132.

STEEL BAR. MARKS, S 8.

Diameter, 1". Speed of rotation, 400 per minute. Length between end bearings, 33". Deflections measured on chord of 10".

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.						Deflections.	Sets.	Remarks.
	Successful.	Total.	On line.		Loaded.		Unloaded.				
			Inch.	Inch.	Inch.	Inch.	Inch.	Inch.			
Pounds. 40,000	0	0	a	.1996	.1702	.1997	.0295	.0001	Inch. .0295 — .0001 .0001 .0003 .0022 0	0	Test discontinued.
			b	.2002	.1705	.1998	.0293	.0001			
			c	.1998	.1699	.1992	.0293	.0001			
87,900	87,900	a	.1988	.1682	.1985	.0303	.0003	Inch. .0303 .0302 .0297	0	Test discontinued.	
		b	.2011	.1687	.1989	.0302	.0022				
		c	1.986	.1689	.1980	.0297	0				



No. 133.

STEEL BAR. MARKS, S 8.

Diameter, 1". Speed of rotation, 400 per minute. Length between end bearings, 33". Deflections measured on chord of 10".

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.		Loaded.			
				Unloaded.	Unloaded.				
Pounds. 40,000	0	0	a b c	Inch.	Inch.	Inch.	Inch.	.0234 .0238 .0236 .0300 .0297 .0239 Test discontinued.	.0001 .0002 .0001 .0003 .0002 .0020
				.1991	.1990	.1975	.0234		
				.1995	.1995	.1875	.0238		
60,000	60,000	60,000	a b c	.1997	.1877	.1875	.0236	.0001 .0003 .0002 .0020	
				.2009	.1899	.1867	.0297		
				.2005	.1886	.1985	.0239		

No. 134.

STEEL BAR. MARKS, S 8.

Diameter, 1". Speed of rotation, 400 per minute. Length between end bearings, 33". Deflections measured on chord of 10".

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.		Loaded.			
				Unloaded.	Unloaded.				
Pounds. 40,000	0	0	a b c	Inch.	Inch.	Inch.	Inch.	.0300 .0239 .0239 .0239 .0300 .0302 Test discontinued.	.0001 .0002 .0001 .0002 .0011 .0010 .0024
				.2001	.1999	.1999	.0300		
				.2000	.1700	.1999	.0239		
124,000	124,000	124,000	a b c	.2001	.1700	.1999	.0239	.0001 .0002 .0011 .0010 .0024	
				.2000	.1891	.1989	.0238		
				.1994	.1824	.1884	.0300		
				.2015	.1689	.1891	.0302		

No. 123.

COLD ROLLED IRON BAR. No. 1.

Diameter, 1". Speed of rotation, 400 per minute. Length between end bearings, 33". Deflections measured on chord of 10".

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.	
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.				
Pounds. 40,000	0	0	a	.1998	.1681	.1994	.0315	Inch. .0002		
			b	.2010	.1692	.2007	.0315	.0003		
			c	.1990	.1673	.1989	.0316	.0001		
10,000	10,000		a	.1998	.1681	.1994	.0315	.0002		
			b	.2009	.1689	.2006	.0317	.0003		
			c	.1992	.1670	.1989	.0319	.0008		
40,000	40,000	50,000	a	.2000	.1677	.1995	.0318	.0005		
			b	.2008	.1686	.2004	.0318	.0004		
			c	.1994	.1668	.1988	.0320	.0006		
50,000	50,000	100,000	a	.1993	.1676	.1993	.0317	.0009		
			b	.2014	.1688	.2005	.0318	.0004		
			c	.1998	.1670	.1989	.0319	.0009		
100,500	100,500	200,500	a	.2002	.1676	.1995	.0319	.0007		
			b	.2016	.1688	.2006	.0318	.0010		
			c	.1994	.1670	.1988	.0318	.0006		
90,800	90,800	300,800	a	.2000	.1673	.1993	.0320	.0007		
			b	.2017	.1685	.2004	.0319	.0013		
			c	.1998	.1670	.1989	.0319	.0009		
99,700 85,000	99,700 85,000	400,000 485,500	.....						.....	Scored at middle bearing. Bar ruptured.
			.....						.....	





No. 126.

COLD ROLLED IRON BAR. No. 1.

Diameter, 1". Speed of rotation, 400 per minute. Length between end bearings, 33". Deflections measured on chord of 10".

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds. 80,000	0	0	a	.2013	.1772	.2010	.0238	Inch. .0002 .0002 0.	
			b	.1960	.1756	.1994	.0238		
			c	.1962	.1754	.1992	.0238		
10,000	10,000	a	.2012	.1772	.2010	.0238	.0002		
		b	.1967	.1758	.1994	.0236			
		c	.1966	.1756	.1994	.0238			
40,000	40,000	a	.2014	.1771	.2012	.0241	.0002		
		b	.1967	.1756	.1994	.0238			
		c	.1966	.1755	.1993	.0238			
50,000	50,000	a	.2013	.1771	.2010	.0239	.0008		
		b	.1967	.1757	.1994	.0237			
		c	.1965	.1755	.1993	.0238			
400,000	400,000	500,000							
4,520,000	4,520,000	5,020,000							
31,700	31,700	5,051,700							

Scored at middle bearing.  
Indication of crack. Diameter of bar at bearing reduced .01.  
Bar ruptured  $\frac{3}{4}$ " from edge of bearing.

No. 127.

COLD ROLLED IRON BAR. No. 1.

Diameter, 1". Speed of rotation, 400 per minute. Length between end bearings, 33". Deflections measured on chord of 10".

Maximum fiber stress per square inch.	Number of rotations.		On line.	Micrometer readings for deflections.		Deflections.	Sets.	Remarks.	
	Successive.	Total.		Unloaded.	Loaded.				Unloaded.
Pounds 80, 000	0	0	a	Inch. .1989	Inch. .1760	Inch. .0237	Inch. .0002		
			b	.2001	.1780	.0239			.0002
			c	.1988	.1787	.0238			.0003
10, 000	10, 000	a	.1988	.1762	.0236	0.	0.		
		b	.2007	.1785	.0239	.0003			
		c	.1988	.1758	.0237	.0003			
40, 000	40, 000	a	.1988	.1758	.0240	0.	0.		
		b	.2038	.1768	.0239	.0003			
		c	.1998	.1758	.0237	.0003			
50, 000	50, 000	a	.2002	.1764	.0237	.0001	Middle bearing slightly scored.		
		b	.2015	.1775	.0237	.0003			
		c	.2002	.1762	.0237	.0003			
1, 630, 000 8, 800	1, 630, 000 1, 638, 600							Indication of crack. Bar ruptured.	

No. 128.  
**COLD ROLLED IRON BAR. No. 2.**  
 Diameter, 1". Speed of rotation, 400 per minute. Length between end bearings, 33". Deflections measured on chord of 10".

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.						Deflections.	Sets.	Remarks.	
	Successive.	Total.	On line.	Loaded.		Unloaded.						
				Inch.	Inch.	Inch.	Inch.					
Pounds. 50,000	0	0	a	.2009	.1607	.2008	.0401	.0001	Inch. .0401 .0399 .0397	Inch. .0001 .0003	Gradual increase of temperature.	
			b	.2010	.1608	.2007	.0399	.0003				
			c	.2004	.1604	.2001	.0397	.0003				
10,000	10,000	10,000	a	.2030	.1593	.1993	.0403	.0084	.0403 .0404 .0397	.0084 .0081 .0029	Gradual increase of temperature.	
			b	.2027	.1592	.1996	.0404	.0081				
			c	.2013	.1587	.1984	.0397	.0029				
87,700	87,700	47,700	.....									Bar ruptured. The middle bearing was scored, and temperature of bar had increased to 150° Fahr.

No. 129.  
**COLD ROLLED IRON BAR. No. 2.**  
 Diameter, 1". Speed of rotation, 400 per minute. Length between end bearings, 33". Deflections measured on chord of 10".

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.						Deflections.	Sets.	Remarks.	
	Successive.	Total.	On line.	Loaded.		Unloaded.						
				Inch.	Inch.	Inch.	Inch.					
Pounds. 50,000	0	0	a	.2015	.1616	.2018	.0400	.0001	Inch. .0397 .0397 .0394	Inch. .0002 .0002 .0002	Gradual increase of temperature.	
			b	.2002	.1602	.1999	.0401	.0028				
			c	.2006	.1610	.2004	.0394	.0027				
10,000	10,000	10,000	a	.1992	.1591	.1991	.0400	.0001	.0400 .0401 .0394	.0001 .0028 .0027	Gradual increase of temperature.	
			b	.2017	.1590	.1991	.0401	.0028				
			c	.2021	.1600	.1994	.0394	.0027				
46,200	46,200	56,200	.....									Bar ruptured. The middle bearing was scored, and temperature of bar had increased to 150° Fahr.

No. 137.

COLD ROLLED IRON BAR. No. 2.

Diameter, 1". Speed of rotation, 400 per minute. Length between end bearings, 33". Deflections measured on chord of 10".

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Loaded.		Unloaded.			
				Inch.	Inch.				
Pounds 40,000	0	0	a	.2011	.1682	Inch. .2008	.0316	Inch. .0008	
			b	.2004	.1689	.2002	.0313	.0002	
			c	.2007	.1688	.2004	.0316	.0003	
100,000	100,000	100,000	a	.2009	.1683	.2008	.0315	.0001	
			b	.2002	.1686	.2000	.0314	.0002	
			c	.2011	.1689	.2005	.0316	.0006	
	225,300	325,300	.....						Bar ruptured.

No. 138.

COLD ROLLED IRON BAR. No. 2.

Diameter, 1". Speed of rotation, 400 per minute. Length between end bearings, 33". Deflections measured on chord of 10".

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflection.	Sets.	Remarks.
	Successive.	Total.	On line.	Loaded.		Unloaded.			
				Inch.	Inch.				
Pounds 40,000	0	0	a	.2017	.1690	Inch. .2015	.0316	Inch. .0003	
			b	.2002	.1686	.2001	.0315	.0001	
			c	.2007	.1682	.2005	.0313	.0002	
100,000	100,000	100,000	a	.2012	.1683	.2012	.0319	0	
			b	.2004	.1683	.2000	.0317	.0004	
			c	.2010	.1689	.2008	.0314	.0007	
150,000	150,000	250,000	a	.2014	.1688	.2010	.0322	.0004	Test discontinued.
			b	.2008	.1684	.2000	.0316	.0008	
			c	.2005	.1685	.2001	.0316	.0004	



No. 139.  
COLD ROLLED IRON BAR. No. 2.

Diameter, 1". Speed of rotation, 400 per minute. Length between end bearings, 33". Deflections measured on chord of 10".

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.	
	Successive.	Total.	On line.	Loaded.		Unloaded.				
				Inch.	Inch.	Inch.				Inch.
Pounds. 40,000	0	0	a	.2009	.1688	.2007	.0314	Inch. .0002		
			b	.2002	.1686	.1999	.0318	.0003		
			c	.2010	.1690	.2008	.0318	.0002		
100,000	100,000	100,000	a	.2015	.1684	.2010	.0316	.0005		
			b	.2004	.1688	.2002	.0314	.0002		
			c	.2011	.1690	.2008	.0318	.0008		
50,000	50,000	150,000	a	.2009	.1692	.2005	.0313	.0004	Test discontinued.	
			b	.2005	.1685	.1999	.0314	.0008		
			c	.2014	.1692	.2009	.0317	.0005		

No. 140.  
COLD ROLLED IRON BAR. No. 3.

Diameter, 1". Speed of rotation, 400 per minute. Length between end bearings, 33". Deflections measured on chord of 10".

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.	
	Successive.	Total.	On line.	Loaded.		Unloaded.				
				Inch.	Inch.	Inch.				Inch.
Pounds. 45,000	0	0	a	.1990	.1688	.1987	.0340	Inch. .0003		
			b	.2014	.1690	.2010	.0350	.0004		
			c	.2002	.1647	.1998	.0351	.0004		
50,000	50,000	50,000	a	.1974	.1620	.1974	.0354	0.	Bar ruptured.	
			b	.2025	.1691	.2014	.0353	.0011		
			c	.2021	.1656	.2008	.0353	.0013		
100,500	100,500	192,500	.....							

No. 141.

## COLD ROLLED IRON BAR. No. 3.

Diameter, 1". Speed of rotation, 400 per minute. Length between end bearings, 33". Deflections measured on chord of 10".

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.		Unloaded.				
			Unloaded.	Loaded.	Unloaded.	Loaded.			
Pounds. 45,000	0	0	a	Inch. .2009	Inch. .1855	Inch. .2006	Inch. .0851	Inch. .0002	
			b	.1983	.1881	.1981	.0851	.0002	
			c	.2010	.1686	.2007	.0852	.0003	
40,000	40,000	40,000	a	.2013	.1846	.2000	.0854	.0013	
			b	.2001	.1822	.1973	.0850	.0029	
			c	.2015	.1644	.2000	.0854	.0015	
	70,500	116,500							Bar ruptured.

No. 142.

## COLD ROLLED IRON BAR. No. 3.

Diameter, 1". Speed of rotation, 400 per minute. Length between end bearings, 33". Deflections measured on chord of 10".

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.		Unloaded.				
			Unloaded.	Loaded.	Unloaded.	Loaded.			
Pounds. 45,000	0	0	a	Inch. .2001	Inch. .1846	Inch. .1999	Inch. .0853	Inch. .0002	
			b	.2008	.1854	.2006	.0852	.0008	
			c	.2000	.1843	.1996	.0858	.0004	
100,000	100,000	100,000	a	.1995	.1837	.1987	.0855	.0008	
			b	.1995	.1829	.1989	.0854	.0012	
			c	.2020	.1824	.1985	.0861	.0035	
25,000	25,000	125,000	a	.2071	.1642	.2005	.0863	.0028	Test discontinued.
			b	.1985	.1820	.1978	.0858	.0077	
			c	.2010	.1610	.1968	.0876	.0024	

No. 143.

COLD ROLLED IRON BAR. No. 3.

Diameter, 1". Speed of rotation, 400 per minute. Length between end bearings, 33". Deflections measured on chord of 10".

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.						Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.		Loaded.		Unloaded.				
			Unloaded.	Loaded.	Unloaded.	Loaded.	Unloaded.	Loaded.			
Pounds 45,000	0	0	a	Inch. .1983		Inch. .1628		Inch. .1980	Inch. .0353	Inch. .0008 .0002 .0003 .0001 .0031 .0024	Test discontinued.
			b	.2011		.1657		.2009	.0352		
			c	.2002		.1645		.1999	.0354		
	80,000	80,000	a	.1968		.1698		.1957	.0351		
			b	.2027		.1642		.1996	.0354		
			c	.2019		.1640		.1995	.0355		

No. 144.

COLD ROLLED IRON BAR. No. 3.

Diameter, 1". Speed of rotation, 400 per minute. Length between end bearings, 33". Deflections measured on chord of 10".

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.						Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.		Loaded.		Unloaded.				
			Unloaded.	Loaded.	Unloaded.	Loaded.	Unloaded.	Loaded.			
Pounds. 45,000	0	0	a	Inch. .2000		Inch. .1645		Inch. .1999	Inch. .0354	Inch. .0001 .0003 .0002 .0014 .0025 .0013	Test discontinued.
			b	.1993		.1641		.1990	.0349		
			c	.2010		.1650		.2008	.0352		
	40,000	40,000	a	.2008		.1640		.1984	.0354		
			b	.2017		.1631		.1982	.0351		
			c	.2015		.1649		.2002	.0353		

No. 145.

COLD ROLLED IRON BAR. No. 4.

Diameter, 1". Speed of rotation, 400 per minute. Length between end bearings, 33". Deflections measured on chord of 10".

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Loaded.		Unloaded.			
				Inch.	Inch.				
Pounds. 50,000	0	0	a	.2008	.1610	.2005	.0385	Inch. .0003 .0003 .0004	
			b	.2000	.1607	.1987	.0390		
			c	.2019	.1620	.2015	.0385		
	47,050	47,050							Bar ruptured.

No. 146.

COLD ROLLED IRON BAR. No. 4.

Diameter, 1". Speed of rotation, 400 per minute. Length between end bearings, 33". Deflections measured on chord of 10".

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Loaded.		Unloaded.			
				Inch.	Inch.				
Pounds. 50,000	0	0	a	.2002	.1606	.2000	.0384	Inch. .0002 .0002 .0001	
			b	.2014	.1623	.2012	.0389		
			c	.1998	.1604	.1997	.0383		
	40,000	40,000	a	.2076	.1616	.2015	.0399	.0061	Test discontinued.
			b	.2010	.1596	.2011	.0395	.0011	
			c	.1990	.1574	.1973	.0389	.0017	

No. 147.

COLD ROLLED IRON BAR. No. 4.

H. Diameter, 1". Speed of rotation, 400 per minute. Length between end bearings, 33". Deflections measured on chord of 10".

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Loaded.		Unloaded.			
				Inch.	Inch.				
Pounds. 50,000	0	0	c	.2011	.1618	.2009	.0391	Inch. .0007 .0002 .0008 .0022 .0076 .0048	Test discontinued.
			d	.2014	.1620	.2012	.0392		
			e	.1993	.1596	.1990	.0394		
20,000	20,000	20,000	f	.2006	.1588	.1984	.0396	.0072 .0395 .0396	Test discontinued.
			g	.2007	.1586	.1981	.0395		
			h	.2027	.1585	.1981	.0396		

No. 148.

COLD ROLLED IRON BAR. No. 4.

H. Diameter, 1". Speed of rotation, 400 per minute. Length between end bearings, 33". Deflections measured on chord of 10".

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Loaded.		Unloaded.			
				Inch.	Inch.				
Pounds. 50,000	0	0	a	.2009	.1611	.2006	.0395	Inch. .0003 .0003 .0002 .0001 .0034 .0048	Test discontinued.
			b	.2005	.1612	.2002	.0390		
			c	.2008	.1611	.2007	.0388		
5,000	5,000	5,000	d	.1975	.1578	.1974	.0396	.0001 .0393 .0397	Test discontinued.
			e	.2005	.1578	.1971	.0394		
			f	.2043	.1568	.1995	.0397		

No. 135.

WROUGHT IRON BAR. No. 1.

Diameter, 1". Speed of rotation, 400 per minute. Length between end bearings, 33". Deflections measured on chord of 10".

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.						Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.		Loaded.		Unloaded.				
			Inch.	Inch.	Inch.	Inch.	Inch.	Inch.			
Pounds. 85,000	0	0	a	.1988	.1726	.1985	.0259	.0003	Inch. .0259 .0003 .0001 .0001 .0002 .0002 .0001		
			b	.1986	.1726	.1985	.0259	.0001			
			c	.1989	.1728	.1988	.0259	.0001			
	1,004,000	1,004,000	a	.1989	.1728	.1987	.0259	.0002			
			b	.1987	.1726	.1985	.0259	.0002			
			c	.1989	.1729	.1988	.0259	.0001			
	189,160	1,183,160								Bar ruptured.	

No. 136.

WROUGHT IRON BAR. No. 1.

Diameter, 1". Speed of rotation, 400 per minute. Length between end bearings, 33". Deflections measured on chord of 10".

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.						Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.		Loaded.		Unloaded.				
			Inch.	Inch.	Inch.	Inch.	Inch.	Inch.			
Pounds. 85,000	0	0	a	.1988	.1737	.1997	.0260	.0001	Inch. .0260 .0001 .0001 .0001 .0260 .0260		
			b	.1989	.1737	.1997	.0260	.0001			
			c	.1987	.1738	.1996	.0260	.0001			
	373,085	373,085								Middle bearing out. Test discontinued.	

No. 30.

CAST (GUN) IRON BAR. No. 4.

Original diameter, 1". Speed of rotation, 400 per minute. Length between end bearings, 33". Deflections measured on chord of 10".

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successful.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds. 15,000	.....	37, 277, 000	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Removed from machine and rested 14 months. Middle bearing reduced by wear to ".998. Test resumed.
15,000	0	37, 277, 000	\$.2015 \$.2016 \$.2016 \$.2010	\$.1920 \$.1819 \$.1818 \$.1818	\$.2010 \$.2009 \$.2004	.0190 .0190 .0190 .0191	.0008 .0005 .0007 .0006		
	10,000	37, 287, 000	\$.2016 \$.2017 \$.2010	\$.1819 \$.1820 \$.1818	\$.2010 \$.2009 \$.2004	.0191 .0189 .0191	.0008 .0008 .0006		
	9,998,500	47, 283, 500	.....	.....	.....	.....	.....	Diameter worn down to ".998. Bar ruptured.	

Chemical composition.

Total carbon.....	2.524	Silicon.....	1.059
Graphitic carbon.....	1.998	Sulphur.....	0.070
Combined carbon.....	0.526	Phosphorus.....	0.433
Manganese.....	0.335	Copper.....	0.008

ENDURANCE OF ROTATING SHAFTS.  
SUMMARIZED TABULATION.

No of test	Material.	Marks.	Speed of rotation per minute.	Maximum fiber stress per square inch.	Number of rotations.		Remarks.
					Successive.	Total.	
120	Steel	15	400	Pounds 40,000	6,578,400	6,578,400	Bar ruptured.
121	do	20	400	40,000	848,200	848,200	Do.
122	do	27 1/2	400	40,000	766,000	766,000	Do.
123	do	S 8	400	30,000	12,000	12,000	
				26,000	40,000	40,000	
				40,000	153,400	173,400	Do.
131	do	S 8	400	40,000	104,000	104,000	Test discontinued.
132	do	S 8	400	40,000	87,900	87,900	Do.
133	do	S 8	400	40,000	64,000	60,000	Do.
134	do	S 8	400	40,000	124,000	124,000	Do.
135	do	1	400	40,000	485,000	485,000	Bar ruptured.
136	do	1	400	40,000	293,800	293,800	Do.
137	do	1	400	40,060	318,500	318,500	Do.
138	do	1	400	30,000	5,051,700	5,051,700	Bar ruptured 1/4" from edge of bearing.
139	do	1	400	50,000	1,638,600	1,638,600	Bar ruptured.
140	do	2	400	50,000	47,700	47,700	Do.
141	do	2	400	50,000	86,200	86,200	Do.
142	do	2	400	40,000	325,300	325,300	Do.
143	do	2	400	40,000	250,000	250,000	Test discontinued.
144	do	3	400	40,000	186,000	150,000	Do.
145	do	3	400	45,000	192,500	192,500	Bar ruptured.
146	do	3	400	45,000	116,500	116,500	Do.
147	do	3	400	45,000	125,000	125,000	Test discontinued.
148	do	3	400	45,000	80,000	80,000	Do.
149	do	4	400	40,000	40,000	40,000	Do.
150	do	4	400	50,000	47,050	47,050	Bar ruptured.
151	do	4	400	50,000	40,000	40,000	Test discontinued.
152	do	4	400	50,000	20,000	20,000	Do.
153	do	4	400	50,000	5,000	5,000	Do.
154	do	4	400	35,000	1,193,160	1,193,160	Bar ruptured.
155	Wrought iron	1	400	35,000	372,085	372,085	Test discontinued.
156	do	1	400	15,000	37,151,900	37,151,900	Rested 8 months.
157	do	.....	400	15,000	37,125,100	37,125,100	Rested 14 months.
158	Cast (gun) iron	.....	22, 400	15,000	9,990,500	9,990,500	Bar ruptured.



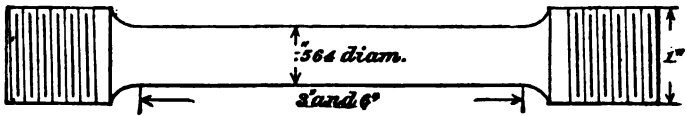
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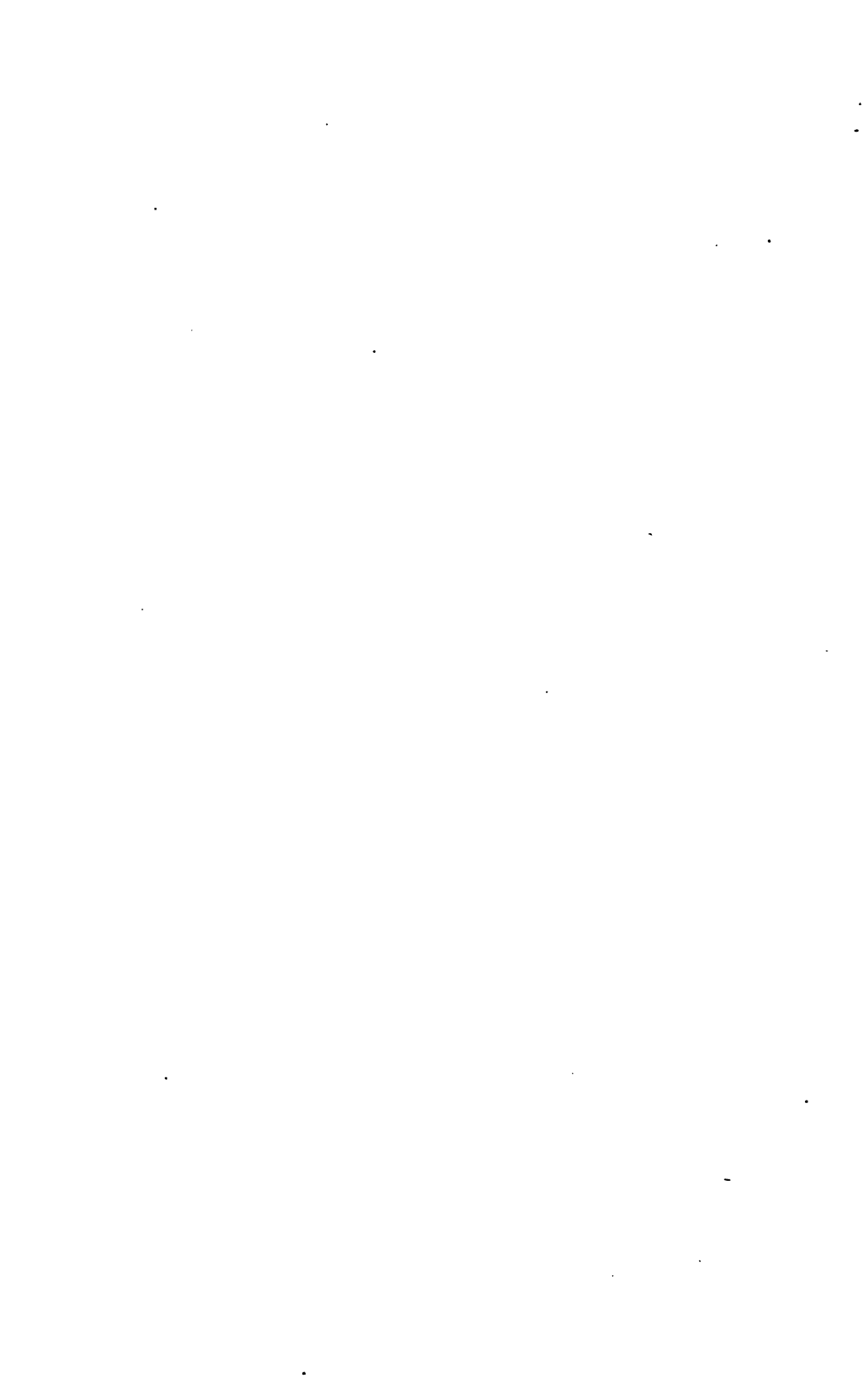
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**TENSION SPECIMENS**  
**FROM**  
**RUPTURED ENDURANCE SHAFTS.**

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STEEL.

No. 4561.

Specimen from outer end of endurance shaft No. 120.  
 Diameter, ".564.  
 Sectional area, .25 square inch.  
 Gauged length, 6".

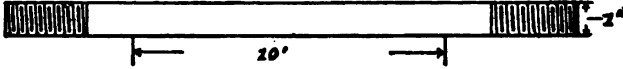
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
250	1,000	0.	0.	Initial load.
1,250	5,000	.0006	0.	
2,500	10,000	.0015	.....	
3,750	15,000	.0025	.....	
5,000	20,000	.0035	.....	
6,250	25,000	.0044	.....	
7,500	30,000	.0054	0.	
8,750	35,000	.0063	.....	
10,000	40,000	.0073	0.	
11,250	45,000	.0083	0.	
12,500	50,000	.0093	0.	
13,750	55,000	.0103	0.	
15,000	60,000	.0114	0.	
16,250	65,000	.0125	0.	
16,500	66,000	.0128	.....	
16,750	67,000	.0130	.....	
17,000	68,000	.0131	.....	
17,250	69,000	.0132	.....	
17,500	70,000	.0134	.....	
17,500	70,000	.0859	.....	Elastic limit.
17,750	71,000	.0672	.....	Second application of load after release and no set shown.
18,000	72,000	.0668	.....	
18,250	73,000	.0708	.....	
18,500	74,000	.0736	.....	
18,750	75,000	.0758	.0536	
19,000	76,000	.0800	.....	
19,250	77,000	.0815	.....	
19,500	78,000	.0830	.....	
19,750	79,000	.0851	.....	
20,000	80,000	.0893	.0651	
22,500	90,000	.12	.....	
25,000	100,000	.16	.....	
27,500	110,000	.22	.....	
28,750	115,000	.25	.....	
30,000	120,000	.33	.....	
31,250	125,000	.50	.....	
31,310	125,240	.....	.....	Tensile strength.
0	0	.54	.....	= 9.0 per cent.

Elongation of inch sections, ".07, ".07, ".08, ".09, ".12, ".11\*.  
 Diameter at fracture, ".53: Area, .221 square inch.  
 Contraction of area, 11.6 per cent.  
 Fractured at neck, at punch mark. Appearance, fine granular.

STEEL.

No. 4563.

Specimen from outer end of endurance shaft No. 120.



Diameter, 1".  
 Sectional area, .7854 square inch.  
 Gauged length, 10".

Applied loads.		In gauged length.		Remarks.	
Total.	Per square inch.	Elongation.	Set.		
Pounds.	Pounds.	Inch.	Inch.		
785	1,000	0.	0.	Initial load.	
8,927	5,000	.0012	-----		
7,854	10,000	.0029	-----		
11,781	15,000	.0046	-----		
15,008	20,000	.0061	-----		
19,535	25,000	.0079	-----		
23,462	30,000	.0096	-----		
27,389	35,000	.0112	-----		
31,316	40,000	.0130	-----		
35,243	45,000	.0148	-----		
39,170	50,000	.0162	-----		
		.0162	.0001		After sustaining load 5 minutes.
43,097	55,000	.0180	.0001		
47,024	59,870	.0199	.0001		

Fractured at root of thread. Appearance, fine granular.

STEEL.

No. 4562.

Specimen from outer end of endurance shaft No. 121.  
 Diameter, ".564.  
 Sectional area, .25 square inch.  
 Gauged length, 6".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
250	1,000	0.	0.	
1,250	5,000	.0008	0.	Elastic limit. Load fell.
2,500	10,000	.0018	0.	
5,000	20,000	.0038	0.	
7,500	30,000	.0057	0.	
8,750	35,000	.0066	0.	
10,000	40,000	.0076	0.	
11,250	45,000	.0086	0.	
12,500	50,000	.0098	0.	
13,750	55,000	.0106	0.	
15,000	60,000	.0118	0.	
16,250	65,000	.0128	0.	
16,500	66,000	.0130	0.	
16,750	67,000	.0131	0.	
17,000	68,000	.0133	0.	
17,250	69,000	.0135	0.	
17,500	70,000	.0138	0.	
17,750	71,000	.0141	0.	
16,750	67,000	.0215	0.	
17,000	68,000	.0233	0.	
17,250	69,000	.0349	0.	
17,500	70,000	.0599	0.	
17,750	71,000	.0803	0.	
18,000	72,000	.0920	0.	
18,250	73,000	.0840	0.	
18,500	74,000	.0860	0.	
18,750	75,000	.0901	.0476	
19,000	76,000	.0732	0.	
19,500	78,000	.0772	0.	
20,000	80,000	.0813	0.	
20,500	82,000	.0868	0.	
21,000	84,000	.0910	0.	
21,500	86,000	.0970	0.	
22,000	88,000	.1010	0.	
22,500	90,000	.1060	0.	
25,000	100,000	.15	0.	
27,500	110,000	.19	0.	
28,750	115,000	.23	0.	
30,000	120,000	.28	0.	
31,250	125,000	.35	0.	
32,210	128,640	-----	-----	Tensile strength. = 7.3 per cent.
0	0	.44	-----	

Elongation of inch sections: ".07, ".08, ".08, ".07, ".07\*, ".07\*.

Diameter at fracture, ".54. Area, .229 square inch.

Contraction of area, 8.4 per cent.

Fractured 1.07 from the neck, at center punch mark. Appearance, fine granular.

## STEEL.

No. 4568.

Specimen from outer end of endurance shaft No. 121.

Same form as No. 4563.

Diameter, 1".

Sectional area, .7854 square inch.

Gauged length, 10'.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
785	1,000	0.	0.	Initial load.
3,927	5,000	.0011	0.	
7,854	10,000	.0030	0.	
11,781	15,000	.0046	.....	
15,708	20,000	.0062	.....	
19,635	25,000	.0080	.....	
23,562	30,000	.0098	0.	
27,489	35,000	.0112	.....	
31,416	40,000	.0131	0.	
35,343	50,000	.....	0.	

## COLD ROLLED IRON.

No. 4564.

Specimen from outer end of endurance shaft No. 123.

Diameter, ".564.

Sectional area, .25 square inch.

Gauged length, 6'.

Applied loads.		In gauged length.		Remarks.	
Total.	Per square inch.	Elongation.	Set.		
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>		
250	1,000	0.	0.	Initial load.	
1,250	5,000	.0009	0.		
2,500	10,000	.0020	.....		
3,750	15,000	.0030	.....		
5,000	20,000	.0040	.0001		
6,250	25,000	.0051	.....		
7,500	30,000	.0062	.0001		
8,750	35,000	.0072	.0002		
10,000	40,000	.0082	.0002		
11,250	45,000	.0093	.0002		
12,000	48,000	.0103	.....		
12,250	49,000	.0107	.....		
12,500	50,000	.0110	.0009		
12,750	51,000	.0114	.....		
13,000	52,000	.0121	.....		
13,250	53,000	.0128	.....		
13,500	54,000	.0140	.....		
13,750	55,000	.0150	.0039		
14,000	56,000	.018	.....		
14,500	58,000	.025	.....		
15,000	60,000	.041	.....		
15,500	62,000	.078	.....		
16,000	64,000	.148	.....		
16,500	66,000	.258	.....		
16,980	67,920	.....	.....		Tensile strength = 8.0 per cent.
0.	0.	.48	.....		

Elongation of inch sections, ".22\*, ".06, ".05, ".05, ".06, ".04.

Diameter at fracture, ".45. Area, .159 square inch.

Contraction of area, 36.4 per cent.

Fractured ".55 from neck. Appearance, fine fibrous.

COLD ROLLED IRON.

No. 4566.

Specimen from outer end of endurance shaft No. 123.

Same form as No. 4563.

Diameter, 1".

Sectional area, .7854 square inch.

Gauged length, 10".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
785	1,000	0.	0.	
8,927	5,000	.0015	0.	
7,854	10,000	.0032	.0002	
11,781	15,000	.0082	.0002	
15,708	20,000	.0070	.0001	
19,635	25,000	.0090	.0001	
23,562	30,000	.0108	.0001	
27,489	35,000	.0126	.0001	
31,416	40,000	.0143	.0001	
				Test discontinued.

COLD ROLLED IRON.

No. 4565.

Specimen from outer end of endurance shaft No. 124.

Diameter, ".564.

Sectional area, .25 square inch.

Gauged length, 6".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
250	1,000	0.	0.	
1,250	5,000	.0009	0.	
2,500	10,000	.0019	.....	
3,750	15,000	.0029	.....	
5,000	20,000	.0040	0.	
6,250	25,000	.0051	.....	
7,500	30,000	.0068	0.	
8,750	35,000	.0073	.....	
10,000	40,000	.0084	0.	
11,250	45,000	.0096	0.	
12,500	50,000	.0112	.0008	
12,750	55,000	.0117	.....	
13,000	58,000	.0122	.....	
13,250	57,000	.0127	.....	
13,500	54,000	.0137	.....	
13,750	55,000	.0141	.0022	
14,000	58,000	.0158	.....	
14,250	57,000	.0171	.....	
14,500	58,000	.0203	.....	
14,750	59,000	.0230	.....	
15,000	60,000	.0321	.0187	
17,080	66,220	.....	.....	
0	0	.57	.....	
				Tensile strength. = 9.5 per cent.

Elongation of inch sections, ".06, ".08, ".09, ".07, ".07, ".20\*.

Diameter at fracture, ".47. Area, .174 square inch.

Contraction of area, 30.4 per cent.

Fractured 5" from neck. Appearance, fibrous.

## COLD ROLLED IRON.

No. 4567.

Specimen from outer end of endurance shaft No. 124.

Same form as No. 4563.

Diameter, 1".

Sectional area, .7854 square inch.

Gauged length, 10".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	Pounds.	Inch.	Inch.	
785	1,000	0.	0.	Initial load.
8,927	5,000	.0012	0.	
7,854	10,000	.0031	0.	
11,781	15,000	.0049	-----	
15,708	20,000	.0066	0.	
19,635	25,000	.0082	-----	
23,562	30,000	.0101	0.	
27,489	35,000	.0119	-----	
31,416	40,000	.0138	0.	

## CAST IRON.

No. 4635.

Specimen from outer end of endurance shaft No. 30.

Diameter, ".564.

Sectional area, .25 square inch.

Gauged length, 3".

Applied loads.		In gauged length.		Remarks.	
Total.	Per square inch.	Elongation.	Set.		
Pounds.	Pounds.	Inch.	Inch.		
250	1,000	0.	0.	Initial load.	
500	2,000	.0003	-----		
750	3,000	.0005	-----		
1,000	4,000	.0008	-----		
1,250	5,000	.0010	.0001		
1,500	6,000	.0011	-----		
1,750	7,000	.0013	-----		
2,000	8,000	.0015	-----		
2,250	9,000	.0018	-----		
2,500	10,000	.0020	.0002		
2,750	11,000	.0022	-----		
3,000	12,000	.0025	-----		
3,250	13,000	.0027	-----		
3,500	14,000	.0029	-----		
3,750	15,000	.0032	.0004		
4,000	16,000	.0035	-----		
4,250	17,000	.0038	-----		
4,500	18,000	.0042	-----		
4,750	19,000	.0046	-----		
5,000	20,000	.0051	.0011		
5,250	21,000	.0056	-----		
5,500	22,000	.0062	-----		
5,750	23,000	.0068	-----		
6,000	24,000	.0077	-----		
6,250	25,000	.0030	-----		
7,990	31,980	-----	-----		Tensile strength.

Fractured ".6 from neck. Appearance, fine granular.



CAST IRON.

No. 4636.

Specimen from outer end of endurance shaft No. 30.

Diameter, ".565.

Sectional area, .25 square inch.

Gauged length, 3".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
250	1,000	0.	0.	Initial load.
500	2,000	.0002	.....	
750	3,000	.0004	.....	
1,000	4,000	.0006	.....	
1,250	5,000	.0009	0.	
1,500	6,000	.0010	.....	
1,750	7,000	.0013	.....	
2,000	8,000	.0014	.....	
2,250	9,000	.0015	.....	
2,500	10,000	.0017	0.	
2,750	11,000	.0019	.....	
3,000	12,000	.0021	.....	
3,250	13,000	.0023	.....	
3,500	14,000	.0026	.....	
3,750	15,000	.0029	.0002	
4,000	16,000	.0032	.....	
4,250	17,000	.0036	.....	
4,500	18,000	.0040	.....	
4,750	19,000	.0042	.....	
5,000	20,000	.0048	.0010	
5,250	21,000	.0052	.....	
5,500	22,000	.0059	.....	
5,750	23,000	.0067	.....	
6,000	24,000	.0075	.....	
6,250	25,000	.0082	.0030	
7,830	31,320	.....	.....	Tensile strength.

Fractured ".5 from neck. Appearance, fine granular.

## CAST IRON.

No. 4637.

Specimen from outer end of endurance shaft No. 30.

Diameter, ".564.

Sectional area, .25 square inch.

Gauged length, 3".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
250	1,000	0.	0.	
500	2,000	.0002	.....	
750	3,000	.0004	.....	
1,000	4,000	.0006	.....	
1,250	5,000	.0008	0.	
1,500	6,000	.0009	.....	
1,750	7,000	.0011	.....	
2,000	8,000	.0012	.....	
2,250	9,000	.0014	.....	
2,500	10,000	.0016	0.	
2,750	11,000	.0018	.....	
3,000	12,000	.0021	.....	
3,250	13,000	.0023	.....	
3,500	14,000	.0027	.....	
3,750	15,000	.0029	.0002	
4,000	16,000	.0031	.....	
4,250	17,000	.0034	.....	
4,500	18,000	.0039	.....	
4,750	19,000	.0042	.....	
5,000	20,000	.0048	.0008	
5,250	21,000	.0052	.....	
5,500	22,000	.0067	.....	
5,750	23,000	.0064	.....	
6,000	24,000	.0072	.....	
6,250	25,000	.0081	.0029	
7,100	28,400	.....	.....	Tensile strength.

Fractured ".25 from neck. Appearance, fine granular. Fractured surface contains a blowhole ".08 diameter.

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# ANNULAR TENSION SPECIMENS

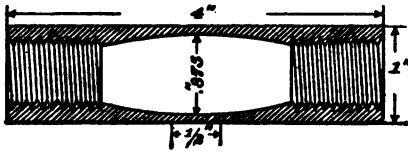
FROM

ENDURANCE SHAFTS NOT RUPTURED.

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FORM OF SPECIMENS.





STEEL.

No. 5774.

Annular specimen from outer end of endurance shaft No. 131.

Diameters, { exterior, 1".  
 interior, ".875.

Sectional area, .184 square inch.

Gauged length, 3".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
184	1,000	0.	0.	
920	5,000	.0001	.....	
1,840	10,000	.0005	.....	
2,760	15,000	.0009	.....	
3,680	20,000	.0012	0.	
4,600	25,000	.0017	.....	
5,520	30,000	.0020	0.	
6,440	35,000	.0023	.....	
7,360	40,000	.0026	0.	
8,096	44,000	.0020	.....	
8,280	45,000	.0200	.....	
8,464	46,000	.0250	.....	
8,648	47,000	.0270	.....	
8,832	48,000	.0300	.....	
9,016	49,000	.0330	.....	
9,200	50,000	.0370	.....	
9,384	51,000	.0409	.....	
9,568	52,000	.0460	.....	
9,752	53,000	.0482	.....	
9,936	54,000	.0530	.....	Tensile strength.
10,120	55,000	.0569	.....	
11,820	64,240	.....	.....	

Elongation of the middle inch section, ".31.

Exterior diameter drawn down to ".82.

Appearance of fracture, silky.

H. Ex. 43—36

## STEEL.

No. 5775.

Annular specimen from middle of endurance shaft No. 131.

Diameters, { exterior, 1".  
                  { interior, ".875.

Sectional area, .184 square inch.

Gauged length, 3"

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
184	1,000	0.	0.	
920	5,000	.0002	.....	Elastic limit.
1,840	10,000	.0006	.....	
2,760	15,000	.0009	.....	
3,680	20,000	.0012	0.	
4,600	25,000	.0017	.....	
5,520	30,000	.0020	0.	
6,440	35,000	.0023	.....	
7,360	40,000	.0028	0.	
7,544	41,000	.0029	.....	
7,728	42,000	.0030	.....	
7,912	43,000	.0032	.....	
8,096	44,000	.0039	.....	
8,280	45,000	.0048	.....	
8,464	46,000	.0051	.....	
8,648	47,000	.0065	.....	
8,832	48,000	.0083	.....	
9,016	49,000	.0102	.....	
9,200	50,000	.0128	.....	
9,384	51,000	.0149	.....	
9,568	52,000	.0165	.....	
9,752	53,000	.0180	.....	
9,936	54,000	.0210	.....	
10,120	55,000	.0260	.0219	Tensile strength.
12,340	67,070	.....	.....	

Elongation of middle inch section, ".27.

Exterior diameter drawn down to ".82.

Appearance of fracture, silky.

STEEL.

No. 4735.

Annular specimen from middle of endurance shaft No. 132.

Diameters, { exterior, 1".  
 { interior, ".875.

Sectional area, .184 square inch.

Gauged length, 3".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
184	1,000	0.	0.	Initial load.
920	5,000	.0001	.....	
1,840	10,000	.0003	.....	
3,680	20,000	.0010	0.	
4,900	25,000	.0012	.....	
5,520	30,000	.0017	— .0001	
5,704	31,000	.0018	.....	
5,888	32,000	.0019	.....	
6,072	33,000	.0019	.....	
6,256	34,000	.0020	.....	
6,440	35,000	.0020	— .0001	
6,624	36,000	.0021	.....	
6,808	37,000	.0021	.....	
6,992	38,000	.0022	.....	
7,176	39,000	.0022	.....	
7,360	40,000	.0023	0.	
7,544	41,000	.0025	.....	
7,728	42,000	.0028	.....	
7,912	43,000	.0029	.....	
8,096	44,000	.0031	.....	
8,280	45,000	.0036	.0005	
8,464	46,000	.0041	.....	
8,648	47,000	.0046	.....	
8,832	48,000	.0060	.....	
9,016	49,000	.0070	.....	
9,200	50,000	.0091	.0056	
9,384	51,000	.0105	.....	
9,568	52,000	.0117	.....	
9,752	53,000	.0138	.....	
9,936	54,000	.0166	.....	
10,120	55,000	.0192	.....	
10,304	56,000	.0230	.....	
10,488	57,000	.0260	.....	
10,672	58,000	.0300	.....	
10,856	59,000	.0340	.....	
11,040	60,000	.0421	.....	
11,224	61,000	.0460	.....	
11,408	62,000	.0530	.....	
11,592	63,000	.0619	.....	
11,776	64,000	.0771	.....	
11,960	65,000	.1002	.....	
12,340	67,070	.....	.....	Tensile strength.

Elongation of middle inch section, ".25.

Appearance of fracture, silky.

## STEEL.

No. 4736.

Annular specimen from outer end of endurance shaft No. 132.

Diameters, { exterior, 1".  
                  { interior, ".875.

Sectional area, .184 square inch.

Gauged length, 3".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
184	1,000	0.	0.	
920	5,000	.0002	.....	
1,840	10,000	.0007	.....	
3,680	20,000	.0012	0.	
4,800	25,000	.0019	.....	
5,520	30,000	.0022	0.	
6,440	35,000	.0024	.....	
7,360	40,000	.0029	.0002	
7,544	41,000	.0153	.....	
7,728	42,000	.0199	.....	
7,912	43,000	.0220	.....	
8,096	44,000	.0241	.....	
8,280	45,000	.0282	.0250	
8,464	46,000	.0293	.....	
8,648	47,000	.0345	.....	
8,832	48,000	.0381	.....	
9,016	49,000	.0432	.....	
9,200	50,000	.0489	.0450	
9,384	51,000	.0523	.....	
9,568	52,000	.0608	.....	
9,752	53,000	.0660	.....	
9,936	54,000	.0701	.....	
10,120	55,000	.0787	.....	
10,304	56,000	.0901	.....	
10,488	57,000	.1031	.....	
10,672	58,000	.1172	.....	
10,856	59,000	.1253	.....	
11,040	60,000	.1500	.....	
11,224	61,000	.....	.....	Tensile strength.

Elongation of middle inch section, ".29.

Appearance of fracture, silky.



STEEL.

No. 4745.

Annular specimen from outer end of endurance shaft No. 133.

Diameters, { exterior, 1".  
                  { interior, ".875.

Sectional area, .184 square inch.

Gauged length, 3".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
184	1,000	0.	0.	
920	5,000	.0001	0.	
1,840	10,000	.0008	-----	
3,680	20,000	.0011	-----	
5,520	30,000	.0019	0.	
5,704	31,000	.0020	-----	
5,888	32,000	.0020	-----	
6,072	33,000	.0021	-----	
6,256	34,000	.0021	-----	
6,440	35,000	.0023	-----	
6,624	36,000	.0023	-----	
6,808	37,000	.0023	-----	
6,992	38,000	.0024	-----	
7,176	39,000	.0024	-----	
7,360	40,000	.0025	0.	
7,544	41,000	.0026	-----	
7,728	42,000	.0027	-----	
7,912	43,000	.0028	-----	
8,096	44,000	.0029	-----	
7,360	40,000	.0070	-----	
7,544	41,000	.0108	-----	
7,728	42,000	.0167	-----	
7,912	43,000	.0203	-----	
8,096	44,000	.0240	-----	
8,280	45,000	.0262	-----	
8,464	46,000	.0283	-----	
8,648	47,000	.0327	-----	
8,832	48,000	.0365	-----	
9,016	49,000	.0410	-----	
9,200	50,000	.0460	-----	
9,384	51,000	.0510	-----	
9,568	52,000	.0560	-----	
9,752	53,000	.0592	-----	
9,936	54,000	.0673	-----	
10,120	55,000	.0769	-----	
10,304	56,000	.0850	-----	
10,488	57,000	.0990	-----	
10,672	58,000	.1098	-----	
11,182	60,770	-----	-----	
				Tensile strength.

Elongation of middle inch section, .25 square inch.

Appearance of fracture, silky.

STEEL.

No. 4746.

Annular specimen from middle of length of endurance shaft No. 133.  
 Diameters, { exterior, 1".  
                   { interior, ".875.  
 Sectional area, .184 square inch.  
 Gauged length, 3".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
184	1,000	0.	0.	
920	5,000	.0002	0.	
1,840	10,000	.0007	0.	
3,680	20,000	.0011	0.	
5,520	30,000	.0020	0.	
5,704	31,600	.0021	-----	
5,888	32,000	.0021	-----	
6,072	33,000	.0022	-----	
6,256	34,000	.0022	-----	
6,440	35,000	.0023	-----	
6,624	36,000	.0023	-----	
6,808	37,000	.0023	-----	
6,992	38,000	.0023	-----	
7,176	39,000	.0023	-----	
7,360	40,000	.0023	0.	
7,544	41,000	.0030	-----	
7,728	42,000	.0031	-----	
7,912	43,000	.0034	-----	
8,096	44,000	.0039	-----	
8,280	45,000	.0042	.0011	
8,464	46,000	.0050	-----	
8,648	47,000	.0060	-----	
8,832	48,000	.0070	-----	
9,016	49,000	.0090	-----	
9,200	50,000	.0107	.0009	
9,384	51,000	.0121	-----	
9,568	52,000	.0140	-----	
9,752	53,000	.0161	-----	
9,936	54,000	.0202	-----	
10,120	55,000	.0240	-----	
10,304	56,000	.0273	-----	
10,488	57,000	.0325	-----	
10,672	58,000	.0360	-----	
10,856	59,000	.0420	-----	
11,040	60,000	.0539	-----	
11,224	61,000	.0600	-----	
11,408	61,630	-----	-----	
				Tensile strength.

Elongation of middle inch section, ".24.  
 Appearance of fracture, silky.



STEEL.

No. 4748.

Annular specimen from middle of length of endurance shaft No. 134.

Diameters, { exterior, 1".  
                  { interior, ".875.

Sectional area, .184 square inch.

Gauged length, 3".

Applied loads.		In gauged length.		Remarks.	
Total.	Per square inch.	Elongation.	Set.		
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>		
184	1,000	0.	0.	Initial load.	
920	5,000	.0002	0.		
1,840	10,000	.0006	0.		
3,680	20,000	.0011	0.		
5,520	30,000	.0020	0.		
6,440	35,000	.0023	0.		
6,624	36,000	.0024	-----		Elastic limit.
6,808	37,000	.0027	-----		
6,992	38,000	.0029	-----		
7,176	39,000	.0030	-----		
7,360	40,000	.0032	.0008		
7,544	41,000	.0037	-----		
7,728	42,000	.0040	-----		
7,912	43,000	.0047	-----		
8,096	44,000	.0052	-----		
8,280	45,000	.0069	-----		
8,464	46,000	.0075	.0037		
8,648	47,000	.0087	-----		
8,832	48,000	.0101	-----		
9,016	49,000	.0119	-----		
9,200	50,000	.0141	.0104		
9,384	51,000	.0162	-----		
9,568	52,000	.0193	-----		
9,752	53,000	.0209	-----		
9,936	54,000	.0238	-----		
10,120	55,000	.0264	-----		
10,304	56,000	.0301	-----		
10,488	57,000	.0246	-----		
10,672	58,000	.0392	-----		
10,856	59,000	.0455	-----		
11,040	60,000	.0524	-----		
11,224	61,000	.0611	-----		
11,408	62,000	.0750	-----		
11,592	63,000	.0894	-----		
11,776	64,000	.1110	-----		
11,890	64,620	.1380	-----	Tensile strength.	

Elongation of middle inch section ".22.  
Appearance of fracture, silky.

COLD ROLLED IRON.

No. 4765.

Annular specimen from middle of length of endurance shaft No. 138.

Diameters, { exterior, 1".  
                  { interior, ".875.

Sectional area, .184 square inch.

Gauged length, 3".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
184	1,000	0.	0.	Initial load.
920	5,000	.0002	.....	
1,840	10,000	.0007	.....	
3,680	20,000	.0012	0.	
4,600	25,000	.0018	.....	
5,520	30,000	.0020	0.	
6,440	35,000	.0022	.....	
7,360	40,000	.0030	.0001	
7,544	41,000	.0030	.....	
7,728	42,000	.0031	.....	
7,912	43,000	.0031	.....	
8,096	44,000	.0033	.....	
8,280	45,000	.0036	.0005	
8,464	46,000	.0038	.....	
8,648	47,000	.0040	.....	
8,832	48,000	.0041	.....	
9,016	49,000	.0046	.....	
9,200	50,000	.0050	.0017	
9,384	51,000	.0056	.....	
9,568	52,000	.0060	.....	
9,752	53,000	.0070	.....	
9,890	53,750	.....	.....	Tensile strength.

Elongation of middle inch section, ".05.

Appearance of fracture, fibrous, 90 per cent, fine granular, 10 per cent.

The granular metal fractured first.

## COLD ROLLED IRON.

No. 4766.

Annular specimen from outer end of endurance shaft No. 138.

Diameters, { exterior, 1".  
                  { interior, ".875.

Sectional area, .184 square inch.

Gauged length, 3".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
184	1,000	0.	0.	
920	5,000	.0002	.....	
1,840	10,000	.0006	.....	
3,680	20,000	.0011	.....	
5,520	30,000	.0017	0.	
6,440	35,000	.0020	.....	
7,360	40,000	.0023	0.	
8,280	45,000	.0028	0.	
8,464	46,000	.0029	.....	
8,648	47,000	.0029	.....	
8,832	48,000	.0030	.....	
9,016	49,000	.0030	.....	
9,200	50,000	.0031	0.	
9,384	51,000	.0031	.....	
9,568	52,000	.0032	.....	
9,752	53,000	.0032	.....	
9,936	54,000	.0033	.....	
10,120	55,000	.0035	.0001	
10,304	56,000	.0037	.....	
10,488	57,000	.0039	.....	
10,672	58,000	.0040	.....	
10,856	59,000	.0041	.....	
11,040	60,000	.0045	.0009	
11,224	61,000	.0050	.....	
11,408	62,000	.0052	.....	
11,592	63,000	.0060	.....	
11,776	64,000	.0067	.....	
11,960	65,000	.0070	.0030	
12,144	66,000	.0080	.....	
12,328	67,000	.0097	.....	
12,512	68,000	.0119	.....	
12,696	69,000	.0141	.....	
12,880	70,000	.0175	.0130	
13,064	71,000	.0189	.....	
13,248	72,000	.0249	.....	
13,432	73,000	.0330	.....	
13,616	73,420	.....	.....	Tensile strength.

Elongation of middle inch section, ".08.

Appearance of fracture, fibrous.

COLD ROLLED IRON.

No. 4767.

Annular specimen from middle of length of endurance shaft No. 139.

Diameters, { exterior, 1".  
 { interior, ".875.

Sectional area, .184 square inch.

Gauged length, 3".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
184	1,000	0.	0.	Initial load.
920	5,000	.0002	.....	
1,840	10,000	.0006	.....	
3,680	20,000	.0012	0.	
4,600	25,000	.0018	.....	
5,580	30,000	.0020	0.	
6,440	35,000	.0023	.....	
7,380	40,000	.0028	0.	
8,280	45,000	.0031	.0001	
9,200	50,000	.0036	.0002	
9,384	51,000	.0037	.....	
9,568	52,000	.0039	.....	
9,752	53,000	.0040	.....	
9,936	54,000	.0041	.....	
10,120	55,000	.0046	.0010	
10,304	56,000	.0050	.....	
10,488	57,000	.0052	.....	
10,672	58,000	.0057	.....	
10,856	59,000	.0062	.....	
11,040	60,000	.0070	.0030	
11,224	61,000	.0084	.....	
11,520	63,610	.....	.....	Tensile strength.

Elongation of middle inch section, ".07.

Appearance of fracture, fibrous; trace of granulation.

## COLD ROLLED IRON.

No. 4768.

Annular specimen from outer end of endurance shaft No. 139.

Diameters, { exterior, 1".  
                  { interior, ".875.

Sectional area, .184 square inch.

Gauged length, 3".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
184	1,000	0.	0.	Initial load.
920	5,000	.0001	.....	
1,840	10,000	.0006	.....	
3,680	20,000	.0012	.....	
4,600	25,000	.0018	.....	
5,520	30,000	.0020	0.	
6,440	35,000	.0023	.....	
7,360	40,000	.0028	0.	
8,280	45,000	.0031	.....	
9,200	50,000	.0036	.0001	
9,384	51,000	.0038	.....	
9,568	52,000	.0039	.....	
9,752	53,000	.0040	.....	
9,936	54,000	.0041	.....	
10,120	55,000	.0044	.0008	
10,304	56,000	.0049	.....	
10,488	57,000	.0051	.....	
10,672	58,000	.0053	.....	
10,856	59,000	.0056	.....	
11,040	60,000	.0060	.0020	
11,224	61,000	.0069	.....	
11,408	62,000	.0072	.....	
11,592	63,000	.0085	.....	
11,776	64,000	.0095	.....	
11,960	65,000	.0104	.0060	
12,144	66,000	.0121	.....	
12,328	67,000	.0149	.....	
12,512	68,000	.0175	.....	
12,696	69,000	.0210	.....	
12,880	70,000	.0282	.0212	
13,320	72,390	.....	.....	Tensile strength.

Elongation of middle inch section, ".09.

Appearance of fracture, fibrous.



COLD ROLLED IRON.

No. 4769.

Annular specimen from middle of length of endurance shaft No. 142.

Diameters, { exterior, 1".  
 { interior, ".875.

Sectional area, .184 square inch.

Gauged length, 3".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
184	1,000	0.	0.	
920	5,000	.0002	.....	
1,840	10,000	.0009	0.	
2,760	15,000	.0014	.....	
3,680	20,000	.0021	0.	
4,600	25,000	.0030	.....	
5,520	30,000	.0045	.0011	
5,704	31,000	.0050	.....	
5,888	32,000	.0053	.....	
6,072	33,000	.0064	.....	
6,256	34,000	.0074	.....	Tensile strength.
6,370	34,620	.....	.....	

Elongation of middle inch section, ".03.

Appearance of fracture, fibrous.

COLD ROLLED IRON.

No. 4770.

Annular specimen from outer end of endurance shaft No. 142

Diameters, { exterior, 1".  
 { interior, ".875.

Sectional area, .184 square inch.

Gauged length, 3".

Applied loads.		In gauged length.		Remarks.	
Total.	Per square inch.	Elongation.	Set.		
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
184	1,000	0.	0.		
920	5,000	.0002	.....		
1,840	10,000	.0007	.....		
3,680	20,000	.0011	.....		
5,520	30,000	.0018	-.0001		
6,440	35,000	.0020	.....		
7,360	40,000	.0031	.....		
12,510	69,620	.....	.....		Tensile strength.

Elongation of middle inch section, ".10.

Appearance of fracture, fibrous.

Under 43,000 pounds per square inch one end of specimen opened along a longitudinal seam in the metal.

Ring driven over specimen closing longitudinal seam and test resumed.

## COLD ROLLED IRON.

No. 4771.

Annular specimen from middle of length of endurance shaft No. 143.

Diameters, { exterior, 1".  
                  { interior, ".875.

Sectional area, .184 square inch.

Gauged length, 3".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
184	1,000	0.	0.	
920	5,000	.0004	.....	
1,840	10,000	.0008	.....	
2,760	15,000	.0010	.....	
3,680	20,000	.0013	0.	
4,600	25,000	.0018	.....	
5,520	30,000	.0020	.0001	
6,440	35,000	.0022	.....	
6,624	36,000	.0023	.....	
6,808	37,000	.0025	.....	
6,992	38,000	.0026	.....	
7,176	39,000	.0026	.....	
10,620	57,720	.....	.....	Tensile strength.

Elongation of middle inch section, ".06.

Appearance of fracture, fibrous.

Opened a longitudinal seam under 40,000 pounds per square inch.

Ring driven on specimen over threaded end closing up seam, and test resumed.

COLD ROLLED IRON.

No. 4772.

Annular specimen from outer end of endurance shaft No. 143.

Diameters, { exterior, 1".  
 { interior, ".875.

Sectional area, .184 square inch.

Gauged length, 3".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
184	1,000	0.	0.	
920	5,000	.0002	.....	
1,840	10,000	.0008	.....	
2,760	15,000	.0010	.....	
3,680	20,000	.0012	.....	
4,600	25,000	.0018	.....	
5,520	30,000	.0020	0.	
6,440	35,000	.0023	.....	
7,360	40,000	.0029	.0001	
8,280	45,000	.0031	.....	
8,464	46,000	.0032	.....	
8,648	47,000	.0032	.....	
8,832	48,000	.0034	.....	
9,016	49,000	.0036	.....	
9,200	50,000	.0039	.0004	
9,384	51,000	.0041	.....	
9,568	52,000	.0043	.....	
9,752	53,000	.0045	.....	
9,936	54,000	.0050	.....	
10,120	55,000	.0053	.0019	
10,304	56,000	.0060	.....	
10,488	57,000	.0063	.....	
10,672	58,000	.0070	.....	
10,856	59,000	.0075	.....	
11,040	60,000	.0084	.0044	
11,224	61,000	.0099	.....	
11,408	62,000	.0110	.....	
11,592	63,000	.0132	.....	
11,776	64,000	.0148	.....	
11,960	65,000	.0163	.0110	
12,144	71,000	.....	.....	

Elongation of middle inch sections, ".10.

Appearance of fracture, fibrous.

## COLD ROLLED IRON.

No. 4773.

Annular specimen from middle of length of endurance shaft No. 144.

Diameters, { exterior, 4".  
                  { interior, ".875.

Sectional area, .184 square inch.

Gauged length, 3".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
184	1,000	0.	0.	
920	5,000	.0003	0.	
1,840	10,000	.0007	0.	
2,760	15,000	.0011	0.	
3,680	20,000	.0013	0.	
4,600	25,000	.0018	0.	
5,520	30,000	.0020	0.	
6,440	35,000	.0023	0.	
7,360	40,000	.0028	0.	
8,280	45,000	.0031	0.	
8,464	46,000	.0032	0.	
8,648	47,000	.0033	0.	
8,832	48,000	.0036	0.	
9,016	49,000	.0038	0.	
9,200	50,000	.0040	.0009	
9,384	51,000	.0042	0.	
9,568	52,000	.0045	0.	
9,752	53,000	.0049	0.	
9,936	54,000	.0052	0.	
10,120	55,000	.0060	.0023	
10,304	56,000	.0064	0.	
10,488	57,000	.0069	0.	
10,672	58,000	.0073	0.	
10,856	59,000	.0084	0.	
11,040	60,000	.0100	.0059	
11,224	61,000	.0109	0.	
11,408	62,000	.0125	0.	
11,592	63,000	.0140	0.	
11,776	64,000	.0180	0.	
11,960	65,000	.0213	.0170	
12,144	66,000	.0219	0.	
12,328	67,000	.0251	0.	
12,512	68,000	.0350	0.	
12,696	69,000	.0400	0.	
12,880	70,000	.0620	0.	
12,980	70,540	.....	.....	Tensile strength.

Elongation of middle inch section, ".09.

Appearance of fracture, fibrous.

COLD ROLLED IRON.

No. 4774.

Annular specimen from outer end of endurance shaft No. 144.

Diameters, { exterior, 1".  
 { interior, ".875.

Sectional area, .184 square inch.

Gauged length, 3".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
184	1,000	0.	0.	
920	5,000	.0003	.....	
1,840	10,000	.0008	.....	
2,760	15,000	.0011	.....	
3,680	20,000	.0014	.....	
4,600	25,000	.0018	.....	
5,520	30,000	.0021	0.	
6,440	35,000	.0025	.....	
7,360	40,000	.0030	.0001	
8,280	45,000	.0034	.....	
8,464	46,000	.0036	.....	
8,648	47,000	.0038	.....	
8,832	48,000	.0040	.....	
9,016	49,000	.0042	.....	
9,200	50,000	.0047	.0012	
9,384	51,000	.0050	.....	
9,568	52,000	.0052	.....	
9,752	53,000	.0060	.....	
9,936	54,000	.0066	.....	
10,120	55,000	.0072	.0036	
10,304	56,000	.0080	.....	
10,488	57,000	.0092	.....	
10,672	58,000	.0101	.....	
10,856	59,000	.0110	.....	
11,040	60,000	.0128	.0088	
11,224	61,000	.0150	.....	
11,408	62,000	.0185	.....	
11,592	63,000	.0202	.....	
11,776	64,000	.0245	.....	
11,960	65,000	.0287	.0240	
12,144	66,000	.0335	.....	
12,328	67,000	.0450	.....	
12,512	68,000	.0500	.....	
12,696	68,640	.....	.....	Tensile strength.

Elongation of middle inch section, ".10.

Appearance of fracture, fibrous.

H. Ex. 43—37

## COLD ROLLED IRON.

No. 4775.

Annular specimen from middle of length of endurance shaft No. 146.

Diameters, { exterior, 1".  
                  { interior, ".875.

Sectional area, .184 square inch.

Gauged length, 3".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
184	1,000	0.	0.	
820	5,000	.0002	.....	
1,840	10,000	.0007	.....	
2,760	15,000	.0010	.....	
3,680	20,000	.0012	0.	
4,600	25,000	.0017	.....	
5,520	30,000	.0020	0.	
6,440	35,000	.0023	.....	
7,360	40,000	.0029	.0002	
7,544	41,000	.0030	.....	
7,728	42,000	.0031	.....	
7,912	43,000	.0032	.....	
8,096	44,000	.0034	.....	
8,280	45,000	.0038	.0009	
8,464	46,000	.0040	.....	
8,648	47,000	.0042	.....	
8,832	48,000	.0044	.....	
9,016	49,000	.0048	.0019	
9,200	50,000	.0051	.....	
9,384	51,000	.0057	.....	
9,568	52,000	.0062	.....	
9,752	53,000	.0069	.....	
9,936	54,000	.0080	.....	
10,120	55,000	.0099	.0059	
10,304	56,000	.....	.....	Tensile strength.

Elongation of middle inch section, ".05.

• Appearance of fracture, fibrous.

COLD ROLLED IRON.

No. 4776.

Annular specimen from outer end of endurance shaft No. 146.

Diameters, { exterior, 1"  
 { interior, ".875.

Sectional area, .184 square inch.

Gauged length, 3".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
184	1,000	0.	0.	Initial load.
920	5,000	.0002	.....	
1,840	10,000	.0006	.....	
2,760	15,000	.0009	.....	
3,680	20,000	.0011	.....	
4,600	25,000	.0014	.....	
5,520	30,000	.0019	0.	
6,440	35,000	.0022	.....	
7,360	40,000	.0025	0.	
8,280	45,000	.0030	.....	
9,200	50,000	.0034	.....	
9,384	51,000	.0036	.....	
9,568	52,000	.0038	.....	
9,752	53,000	.0040	.....	
9,936	54,000	.0042	.....	
10,120	55,000	.0045	.0010	
10,304	56,000	.0050	.....	
10,488	57,000	.0054	.....	
10,672	58,000	.0060	.....	
10,856	59,000	.0065	.....	
11,040	60,000	.0080	.0040	
11,224	61,000	.0090	.....	
11,408	62,000	.0115	.....	
11,592	63,000	.0140	.....	
11,776	64,000	.0180	.....	
11,960	65,000	.0209	.0104	
12,144	66,000	.0290	.....	
12,300	66,850	.....	.....	Tensile strength.

Elongation of middle inch section, ".07.

Appearance of fracture, fibrous.

## COLD ROLLED IRON.

No. 4777.

Annular specimen from middle of length of endurance shaft No. 147.

Diameters, { exterior, 1".  
                  { interior, ".875.

Sectional area, .184 square inch.

Gauged length, 3".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
184	1,000	0.	0.	
920	5,000	.0001	-----	
1,840	10,000	.0003	-----	
2,760	15,000	.0006	-----	
3,680	20,000	.0009	0.	
4,600	25,000	.0018	-----	
5,520	30,000	.0018	0.	
6,440	35,000	.0022	-----	
7,360	40,000	.0027	0.	
8,280	45,000	.0031	-----	
8,464	46,000	.0033	-----	
8,648	47,000	.0036	-----	
8,832	48,000	.0038	-----	
9,016	49,000	.0040	-----	
9,200	50,000	.0043	.0010	
9,384	51,000	.0048	-----	
9,568	52,000	.0051	-----	
9,752	53,000	.0053	-----	
9,936	54,000	.0060	-----	
10,120	55,000	.0066	.0029	
10,304	56,000	.0072	-----	
10,488	57,000	.0082	-----	
10,672	58,000	.0099	-----	
10,856	59,000	.0109	-----	
11,040	60,000	.0130	.0088	
11,224	61,000	.0151	-----	
11,408	62,000	.0206	-----	
11,592	63,000	.0246	-----	
11,776	64,000	.0325	-----	
11,960	65,000	.0382	.0339	
12,040	65,430	-----	-----	Tensile strength.

Elongation of middle inch section, ".10.

Appearance of fracture, fibrous.



COLD ROLLED IRON.

No. 4778.

Annular specimen from outer end of endurance shaft No. 147.

Diameters, { exterior, 1".  
                  { interior, ".875.

Sectional area, .184 square inch.

Gauged length, 3".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
184	1,000	0.	0.	
920	5,000	.0002	.....	
1,840	10,000	.0005	.....	
2,760	15,000	.0008	.....	
3,680	20,000	.0010	.....	
4,600	25,000	.0013	.....	
5,520	30,000	.0017	0.	
6,440	35,000	.0020	.....	
7,360	40,000	.0023	0.	
8,280	45,000	.0027	.....	
9,200	50,000	.0031	.0001	
9,384	51,000	.0032	.....	
9,568	52,000	.0033	.....	
9,752	53,000	.0033	.....	
9,936	54,000	.0034	.....	
10,120	55,000	.0036	.0003	
10,304	56,000	.0038	.....	
10,488	57,000	.0040	.....	
10,672	58,000	.0043	.....	
10,856	59,000	.0049	.....	
11,040	60,000	.0052	.0017	
11,224	61,000	.0058	.....	
11,408	62,000	.0072	.....	
11,592	63,000	.0092	.....	
11,776	64,000	.0120	.....	
11,960	65,000	.0150	.0107	
12,144	66,000	.0183	.....	
12,328	67,000	.0250	.....	
12,512	68,000	.0410	.....	
				Tensile strength.

Elongation of middle inch section, ".08.

Appearance of fracture, fibrous.

## COLD ROLLED IRON.

No. 4779.

Annular specimen from middle of length of endurance shaft No. 148.

Diameters, { exterior, 1".  
                  { interior, ".875.

Sectional area, .184 square inch.

Gauged length, 3".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
184	1,000	0.	0.	
920	5,000	.0002	.....	
1,840	10,000	.0005	.....	
2,760	15,000	.0008	.....	
3,680	20,000	.0010	0.	
4,600	25,000	.0015	.....	
5,520	30,000	.0019	0.	
6,440	35,000	.0023	.....	
7,360	40,000	.0029	.0001	
8,280	45,000	.0034	.0003	
8,464	46,000	.0036	.....	
8,648	47,000	.0038	.....	
8,832	48,000	.0040	.....	
9,016	49,000	.0044	.....	
9,200	50,000	.0051	.0017	
9,384	51,000	.0058	.....	
9,568	52,000	.0063	.....	
9,752	53,000	.0074	.....	
9,936	54,000	.0089	.....	
10,120	55,000	.0108	.0068	
10,304	56,000	.0126	.....	
10,488	57,000	.0152	.....	
10,672	58,000	.0189	.....	
10,856	59,000	.0260	.....	
11,040	60,000	.0274	.0231	
11,224	61,000	.0440	.....	
				Tensile strength.

Elongation of middle inch section, ".06.

Appearance of fracture, fibrous.

COLD ROLLED IRON.

No. 4780.

Annular specimen from outer end of endurance shaft No. 148.

Diameters, { exterior, 1".  
 interior, ".875.

Sectional area, .184 square inch.

Gauged length, 3".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
184	1,000	0.	0.	
920	5,000	.0002	.....	
1,840	10,000	.0005	.....	
2,760	15,000	.0008	.....	
3,680	20,000	.0010	.....	
4,600	25,000	.0013	.....	
5,520	30,000	.0017	0.	
6,440	35,000	.0020	.....	
7,360	40,000	.0023	0.	
8,280	45,000	.0030	.....	
9,200	50,000	.0037	.0004	
9,384	51,000	.0039	.....	
9,568	52,000	.0041	.....	
9,752	53,000	.0043	.....	
9,936	54,000	.0049	.....	
10,120	55,000	.0057	.0020	
10,304	56,000	.0066	.....	
10,488	57,000	.0075	.....	
10,672	58,000	.0089	.....	
10,856	59,000	.0101	.....	
11,040	60,000	.0123	.0081	
11,224	61,000	.0166	.....	
11,408	62,000	.0228	.....	
11,592	63,000	.0280	.....	
11,776	64,000	{ .0390	.....	
		{ .0510	.....	

Elongation of middle inch section, ".10.

Appearance of fracture, fibrous.

TABULATION OF TENSION SPECIMENS FROM BARS RUPTURED BY ENDURANCE TESTS OF ROTATING SHAFTS.  
SOLID SPECIMENS.

Tension test number.	Endurance test number.	Material.	Location in shaft.	Sectional area.	Elastic limit per square inch.	Tensile strength per square inch.	Gauged length.	Elongation in gauged length.	Contraction of area.	Appearance of fracture.	Elongation of inch sections.
				Sq. in.	Pounds.	Pounds.	Inches.	Per cent.	Per cent.		
4561	120	Steel.....	Outer end.....	.25	69,000	125,240	6	9.0	11.6	.....	" .07", .07", .08", .09", .12", .11"
4563	120	do.....	do.....	.7854	.....	59,870	Fractured at root of thread.	.....	8.4	.....	.....
4562	121	do.....	do.....	.25	71,000	128,840	6	7.8	.....	.....	" .07", .08", .08", .07", .07", .07"
4568	121	do.....	do.....	.7854	.....	150,000	.....	.....	.....	.....	.....
4564	123	Cold rolled iron.....	Outer end.....	.25	.....	67,920	6	8.0	36.4	.....	" .22", .08", .05", .05", .06", .06", .04
4566	123	do.....	do.....	.7854	.....	140,000	.....	.....	.....	.....	.....
4565	124	do.....	do.....	.25	.....	68,320	6	9.5	30.4	.....	" .06", .08", .09", .07", .07", .20"
4567	124	do.....	do.....	.7854	.....	140,000	.....	.....	.....	.....	.....
4635	30	Cast iron.....	Outer end.....	.25	.....	31,960	3	.....	.....	.....	.....
4636	30	do.....	do.....	.25	.....	31,320	3	.....	.....	.....	.....
4637	30	do.....	do.....	.25	.....	28,400	3	.....	.....	.....	.....

† Tensile strength not reached.

SPECIMENS FROM SHAFTS NOT RUPTURED. ANNULAR SPECIMENS.

Tension test num-ber.	Endur-ance test num-ber.	Material.	Location in shaft.	Sectional area.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation of middle inch section.	Appearance of fracture.
5774	131	Steel.	Outer end	.184	44,000	64,240	.31	SILKY.
5775	131	do.	Middle	.184	43,000	67,070	.27	Do.
4765	132	do.	Middle	.184	.....	67,070	.25	Do.
4766	132	do.	Outer end	.184	.....	61,000	.26	Do.
4745	133	do.	Outer end	.184	44,000	60,770	.25	Do.
4746	133	do.	Middle	.184	42,000	91,680	.24	Do.
4747	134	do.	Outer end	.184	40,000	61,120	.22	Do.
4748	134	do.	Middle	.184	36,000	64,620	.22	Do.
4765	138	Cold rolled iron.	Middle	.184	.....	53,750	.05	Fibrous 90 per cent, fine granular 10 per cent.
4766	138	do.	Outer end	.184	.....	73,420	.08	Fibrous.
4767	139	do.	Outer end	.184	.....	62,610	.07	Fibrous, trace of granulation.
4768	139	do.	Middle	.184	.....	72,390	.09	Fibrous.
4769	142	do.	Middle	.184	.....	34,620	.03	Do.
4770	142	do.	Outer end	.184	.....	69,620	.10	Do.
4771	143	do.	Middle	.184	.....	57,720	.06	Do.
4772	143	do.	Outer end	.184	.....	71,960	.10	Do.
4773	144	do.	Middle	.184	.....	70,540	.09	Do.
4774	144	do.	Outer end	.184	.....	68,640	.10	Do.
4775	146	do.	Middle	.184	.....	56,000	.05	Do.
4776	146	do.	Outer end	.184	.....	66,850	.07	Do.
4777	147	do.	Middle	.184	.....	65,480	.10	Do.
4778	147	do.	Outer end	.184	.....	68,000	.08	Do.
4779	148	do.	Middle	.184	.....	61,000	.06	Do.
4780	148	do.	Outer end	.184	.....	64,000	.10	Do.



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CHAIN CABLE.

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SHACKLES AND SWIVELS.

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TENSILE TESTS OF CHAIN CABLE, SHACKLES, AND SWIVELS, FOR U. S. LIGHT-HOUSE INSPECTOR, THIRD DISTRICT.

TESTS OF CHAIN CABLE.

No. of test.	Marks.	Diameters.			Sectional area of chain.	Tensile strength.		Fracture.
		End links.	Outside studded links.	Studded links of chain.		Total.	Per square inch.	
5517	"Bradlee & Co., Philadelphia."	Inches. 1.85	1.85	Inches. 1.80	Sq. inches. 3.33	Pounds. 146,500	41,500	Second link of chain at the side. Fibrous.
5518	do	1.88	1.88	1.90	3.33	149,700	42,410	Second link of chain at the quarter. Fibrous.
5519	do	1.85	1.85	1.90	3.33	143,900	40,760	Do.
5522	do	1.87	1.62	1.90	3.33	143,900	42,120	Middle link at the end. Fibrous.
5551	do	2.18	1.83	1.75	4.81	186,500	40,850	Middle link at side weld. Followed the scarf.
5537	"W. E. R. M. Co., Lebanon, Pa."	1.99	1.99	1.75	4.51	185,040	38,470	Middle link at the weld. In part fibrous and in part following scarf of weld.
5538	do	2.00	1.77	1.77	4.92	196,800	40,000	Middle link in vicinity of the weld; 40 per cent granular; 60 per cent fibrous oblique.
5539	do	2.00	1.76	1.76	4.86	181,958	37,440	End link at the weld.
5571	"U. S. W. N. Y."	2.22	1.74	1.74	4.75	187,700	39,520	First link at the weld. Followed the scarf.
5531	"Bradlee & Co., Philadelphia."	1.93	1.83	1.83	5.28	215,680	41,000	Next to the middle link in the quarter. Fibrous except a small granular spot at the outside of the link.
5549	do	2.22	1.93	1.85	5.38	220,050	40,900	Middle link at weld. Fibrous, slightly granular.
5550	do	2.27	1.98	1.87	5.49	219,900	40,050	First link at weld. Fibrous.
5552	do	2.22	1.95	1.90	5.67	217,250	38,320	First link at weld. Followed the scarf.
5578	do	2.28	2.01	1.85	5.38	217,300	40,390	First link in the quarter. Fibrous.
5577	do	2.23	2.00	1.90	5.67	209,700	36,980	First link in the quarter. Fibrous, 85 per cent; granular, 15 per cent.
5576	do	2.23	1.96	1.91	5.73	205,100	35,790	First link in the quarter. Fibrous.
5577	do	2.30	1.93	1.87	5.49	200,100	36,450	Middle link in the quarter. Fibrous.
5578	do	2.20	1.98	1.90	5.67	218,500	38,550	Do.
5579	do	2.20	1.98	1.93	5.85	214,900	36,730	First link at the side, following scarf, 60 per cent; fibrous, 20 per cent; granular, 20 per cent.
5580	do	2.22	1.93	1.90	5.67	227,200	40,070	Middle link in the quarter. Fibrous.
5715	do	2.20	1.95	1.90	5.67	224,850	39,660	Middle link in the quarter. Fibrous, 80 per cent; granular, 20 per cent.
5716	do	2.20	1.97	1.90	5.67	218,900	38,780	First link in the quarter. Fibrous.
5717	do	2.20	1.98	1.90	5.67	228,400	40,280	Do.
5718	do	2.23	1.96	1.89	5.61	213,800	38,110	Middle link at the side. Followed the scarf of weld.
5463	"J. B. C. & Co. Proved"	2.00	1.87	1.87	5.49	172,750	31,470	First studded link at the weld. Fibrous, trace of granulation.
5464	do	2.02	1.88	1.88	5.55	210,900	38,000	End link at the weld. Fibrous.
5465	do	2.00	1.88	1.88	5.55	196,850	35,470	Middle link at the weld. Followed the scarf.
5466	do	2.00	1.88	1.88	5.55	184,400	34,850	End link at the weld. Followed the scarf.
5467	do	2.00	1.88	1.88	5.55	192,700	34,720	Do.
5468	do	2.00	1.88	1.88	5.55	221,100	39,840	End link at the weld. Fibrous.
5477	do	2.15	1.88	1.88	5.55	190,200	35,890	First studded link at the weld. Fibrous.
5481	do	2.12	1.88	1.88	5.55	187,900	30,250	First studded link at the weld. Fibrous, slightly granular.

TENSILE TESTS OF CHAIN CABLE, SHACKLES, AND SWIVELS, FOR U. S. LIGHT-HOUSE INSPECTOR, THIRD DISTRICT—Cont'd.

TESTS OF CHAIN CABLE—Continued.

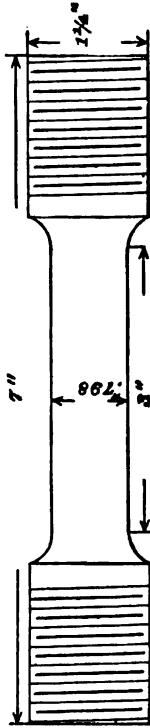
No. of test.	Marks.	Diameters.			Sectional area of chain.	Tensile strength.		Fracture.
		End links.	Outside studded links.	Studded links of chain.		Total.	Per square inch.	
5483	"J. B. C. & Co. Proved"	Inches. 2.12	Inches. .....	Inches. Sq. inches. 1.87 5.49	Pounds. 193,850	Pounds. 35,310	First studded link at the weld. Fibrous.	
5484	do	2.12	.....	1.87 5.49	197,100	35,900	Do.	
5485	do	2.12	.....	1.87 5.49	200,600	36,540	First studded link at the weld. Followed the scarf. Fibrous.	
5486	do	2.12	.....	1.87 5.49	200,980	36,610	Do.	
5489	do	2.12	.....	2.00 6.28	221,900	35,330	Middle link at the weld. Followed the scarf.	
5470	do	2.13	.....	2.02 6.41	204,100	31,840	First studded link at the weld. Followed the scarf.	
5480	do	2.28	.....	2.00 6.28	214,900	34,220	Middle studded link at weld. Fibrous, following scarf.	
5482	do	2.25	.....	2.00 6.28	206,400	32,870	First studded link at the weld. In part fibrous, in part following the scarf.	
5570	U. S. W. N. Y.	.....	.....	1.96 6.03	229,800	38,110	Middle link at weld. Followed the scarf, 50 per cent of which was dark colored. The opposite end of the link fractured, with a granular appearance.	
5703	"Baker Proved"	2.12	.....	2.06 6.66	212,100	31,850	Middle link in the side and the quarter. Granular.	
5704	do	2.11	.....	2.00 6.28	246,200	39,200	First studded link at the weld. Followed the scarf, 40 per cent; granular, 60 per cent.	
5705	do	2.12	.....	2.00 6.28	176,800	28,150	First studded link at the weld and side. Granular.	
5719	do	2.25	.....	1.98 6.16	219,500	35,630	First studded link at weld in end. Followed the scarf.	
5740	"Bradlee & Co., Philadelphia"	2.18	1.97	1.95 5.97	228,100	38,210	Middle link of chain in the side near the stud. Fibrous, 80 per cent; granular, 20 per cent.	
5516	do	2.45	.....	2.23 7.81	271,600	34,780	First studded link in the quarter. Granular, 60 per cent; fibrous, 40 per cent.	
Two studded links and one end link from both samples of chain, tests Nos. 5704 and 5705, were annealed and then tested. No. 5704 was heated bright red and No. 5705 cherry red, and both cooled in the open air.								
5704a	"Baker. Proved"	2.11	.....	2.00 6.28	219,100	34,890	Studded link next end link at the quarter. Fibrous, with trace of granulation. After the link had parted it sustained 88,200 pounds tension as an open link.	
5705a	do	2.12	.....	2.00 6.28	190,100	30,270	Studded link in the quarter. Granular, 50 per cent; fibrous, 50 per cent.	

## DETAILS OF STRETCH UNDER STRESS OF CHAIN TEST NO. 5551.

Applied loads.	Elongation.		Remarks.
	Total.	Successive.	
<i>Pounds.</i>	<i>Inches.</i>	<i>Inches.</i>	
10,000	0.	0.	Initial load.
20,000	.10	.10	
30,000	.18	.08	
40,000	.26	.08	
50,000	.33	.07	
60,000	.39	.06	
70,000	.48	.09	
80,000	.63	.15	
90,000	.83	.20	
100,000	1.16	.33	
110,000	1.54	.38	
120,000	2.00	.46	Snapping sounds.
130,000	2.53	.52	
140,000	3.14	.62	
150,000	3.80	.66	
160,000	4.60	.80	
170,000	5.50	.90	
180,000	6.60	1.10	
190,000	7.98	1.38	
196,500	9.15	1.19	Tensile strength.

TENSION TESTS OF TWO SPECIMENS TAKEN FROM FRACTURED END LINK OF CHAIN TEST NO. 5719, WHICH FRACTURED BEFORE THE STUDDED LINKS OF THE CHAIN.

One specimen taken from each side of the link. One of them tested in the condition the metal was in while in the link; the other specimen was annealed by heating cherry red and cooling in the open air.



No. of test.	Condition.	Diameter.	Sectional area.	Elastic limit.		Tensile strength.		Elongation in 3 inches.		Area at fracture.	Contraction of area.	Appearance of fracture.	Elongation of inch sections.
				Total.	Per square inch.	Total.	Per square inch.	Inch.	Per ct.				
5733	Not annealed.....	.798	.50	Pounds. 17,240	Per square inch. 34,480	Pounds. 20,820	Per square inch. 63,640	Inch. .58	Per ct. 19.3	" Sq. in. Diam. .65 = 332	Per ct. 33.6	Fibrous.....	" " .12, .35*, .11
5734	Annealed.....	.798	.50	Pounds. 13,250	Per square inch. 26,500	Pounds. 24,210	Per square inch. 48,420	Inch. .92	Per ct. 30.6	" Sq. in. Diam. .59 = 273	Per ct. 45.4	.....do.....	" " .49*, .28, .17

TESTS OF SHACKLES AND SWIVELS.

No. of test.	Description.	Tensile strength	Fractured.
		<i>Pounds.</i>	
5700	1½" light ship shackle...	81,300	Across eye. Fibrous.
5701	do .....	90,380	Across eye, with fibrous appearance. Opposite side fractured back of eye. Granular.
5699	1½" light ship shackle...	82,100	Both parts back of the eyes. Fibrous, in part granular.
5755	do .....	85,800	Pulled tongue out of eye.
5756	do .....	97,600	Do.
5757	do .....	95,800	Do.
5752	1½" light ship shackle...	125,480	Bale of shackle.
5753	do .....	116,980	Do.
5754	do .....	115,740	Do.
5698	do .....	100,950	Both parts back of the eyes. Fibrous, in part granular.
5697	1½" light ship shackle...	122,800	One part back of eye. Fibrous, slightly granular.
5750	do .....	154,620	Tongue.
5751	do .....	149,900	Bale of shackle.
5521	1½" shackle .....	152,100	1½" studded link next shackle. Shackle not fractured.
5542	Shackle .....	171,550	Eye across pin hole for securing tongue in position.
5543	do .....	156,200	Do.
5554	1½" shackle .....	246,200	2" studded link next shackle. Shackle not fractured.
5575	do .....	167,100	End across ¾" pin hole. Fibrous, in part granular.
5534	1½" shackle .....	237,990	Studded link next the shackle. Shackle not fractured.
5573	2" shackle .....	191,200	End across ¾" pin hole. Granular, in part fibrous.
5696	2" light ship shackle .....	212,100	Across eye, which had ⅞ round key. Fibrous.
5702	do .....	192,900	Both parts back of eyes. Fibrous, in part granular.
5747	do .....	180,200	Tongue. Granular.
5748	do .....	254,600	Bale of shackle.
5749	do .....	287,580	Do.
5693	2½" buoy shackle .....	165,900	Across both eyes. Fibrous, with granular streaks.
5694	do .....	173,100	Across one eye. Fibrous, with granular streaks.
5741	do .....	273,760	Bale of shackle.
5742	do .....	277,100	Key fractured, after which tongue drew out of eyes of shackle.
5743	do .....	272,300	Sheared tongue.
5744	2½" light ship shackle .....	277,150	Bale of shackle.
5745	do .....	298,600	Do.
5746	do .....	290,300	Do.
5695	do .....	224,000	Across both eyes. Fibrous, with granular streaks.
5520	1½" swivel .....	131,100	Pulled head off stem of swivel.
5535	do .....	181,400	Eye of the stem at the side. Fibrous.
5536	do .....	184,080	Do.
5540	Swivel .....	149,100	Pulled head off stem of swivel.
5541	do .....	161,060	Stem at inner end of eye at shoulder. Fibrous, with granular streak.
5553	1½" swivel .....	250,600	2" studded link next swivel. Swivel not fractured.
5574	do .....	196,300	Pulled head off stem of swivel.
5471	1½" swivel .....	193,400	Neck of the stem of swivel. Fibrous.
5533	do .....	283,100	Studded link 2" diameter next the swivel. Swivel not fractured.
5572	2" swivel .....	274,200	Male part across the eye. Fibrous, slightly granular.
5472	do .....	243,600	Neck of the stem of swivel. Fibrous.
5478	Swivel .....	308,200	Pulled off head of stem. Fibrous 90 per cent granular 10 per cent.
5479	do .....	207,800	Bale of socket at the weld, following the scarf.



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**BOTTOM CASTINGS FOR IRON BUOYS.**

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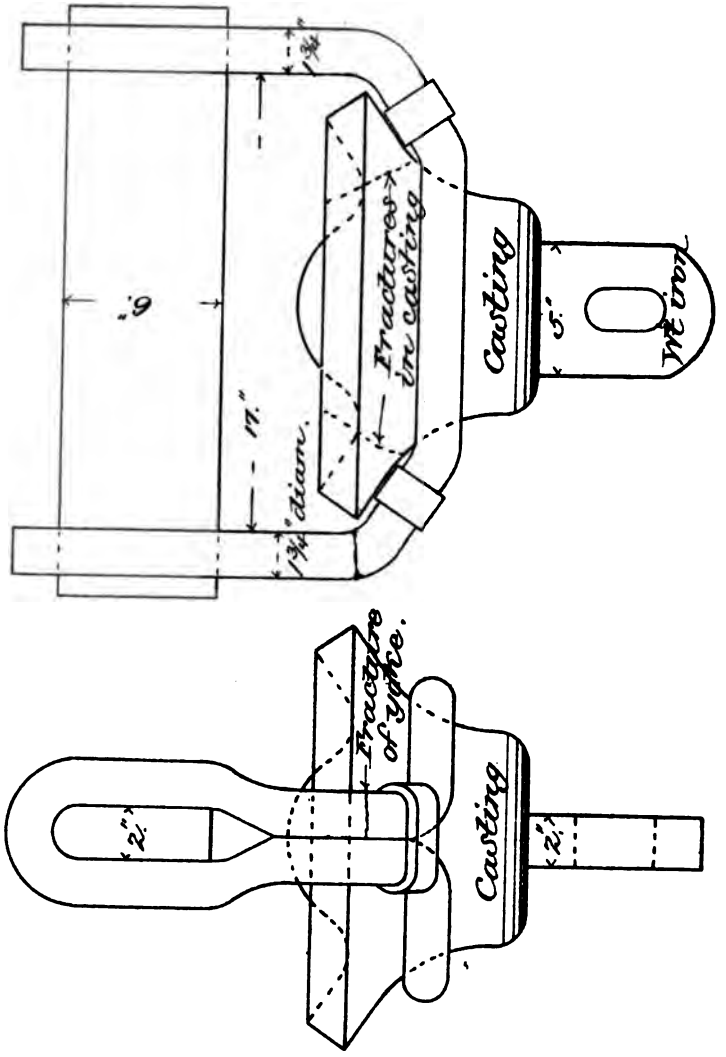
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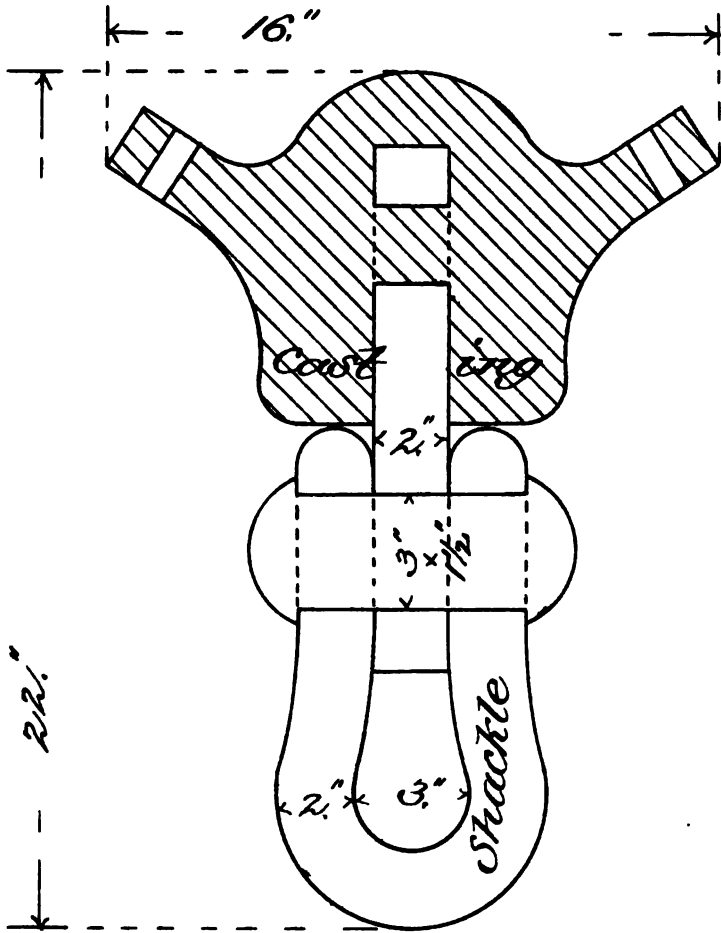




No. 5736



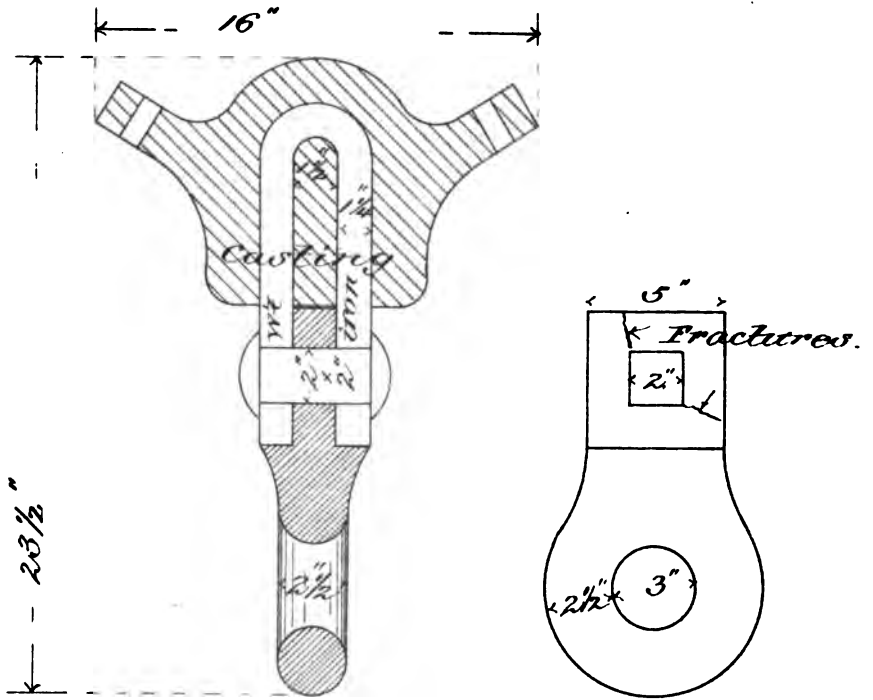
No. 5736







No. 5737



**No. 5736.**

**BOTTOM CASTING WITH ADJUSTABLE SHACKLE.**

Under 169,200 pounds tension the rim of the casting, on opposite sides and under the two parts of the wrought-iron yoke, began to fracture.

There were successive reports of fracturing cast iron under loads of 175,900 pounds, 188,000 pounds, and 210,000 pounds, and pieces were detached from each side of the casting, the lines of fracture extending through five rivet holes each.

At 213,000 pounds tension one part of the wrought-iron yoke fractured, disabling the attachment provided to secure the casting to the testing machine.

The shackle remained intact at the end of the test.

**No. 5737.**

**BOTTOM CASTING WITH ADJUSTABLE EYE FOR FIRST-CLASS BUOY.**

Tensile strength, 129,900 pounds.

Fractured the wrought-iron eye, tearing out the metal in front of the 2" x 2" square pin hole.



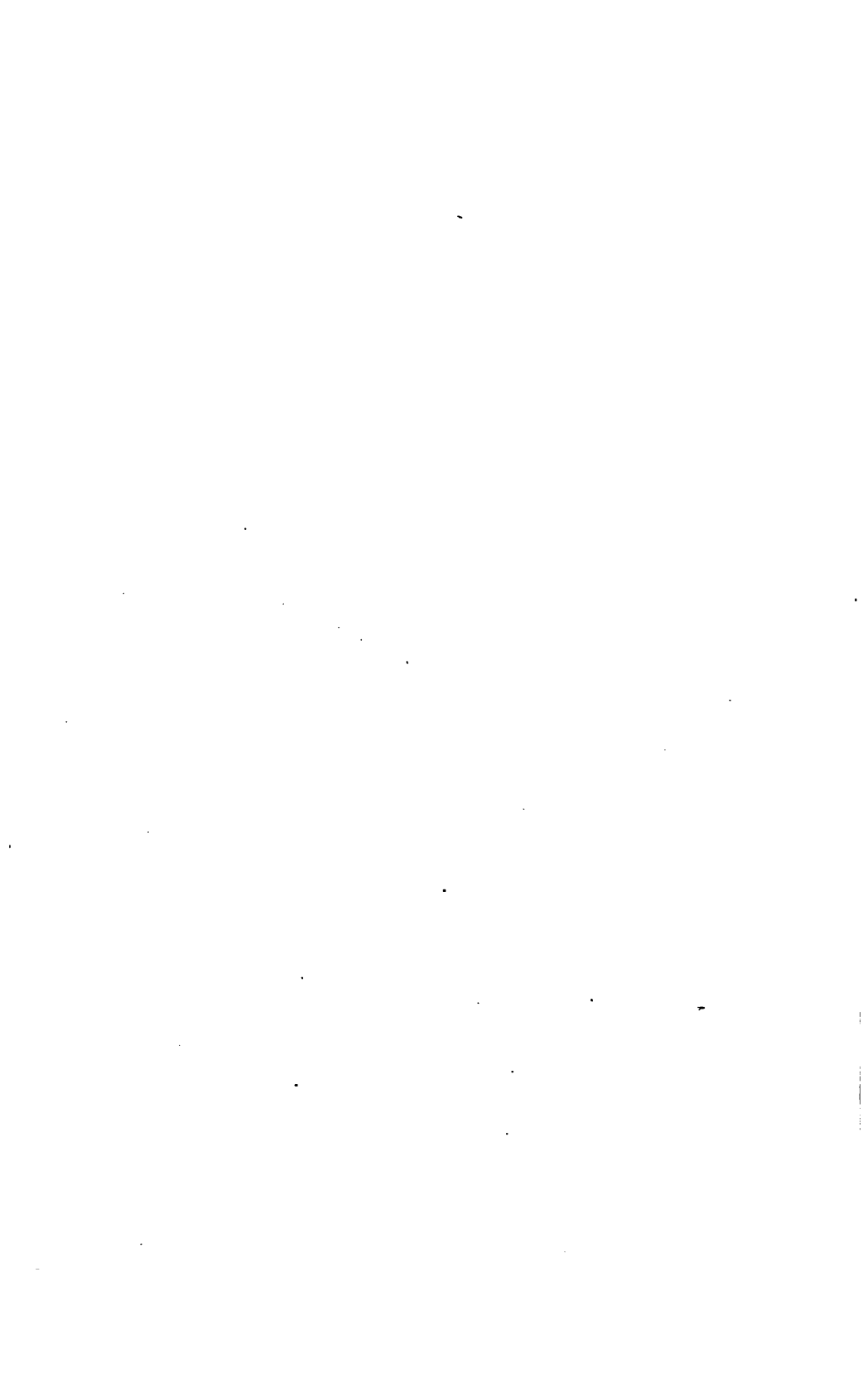


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## WIRE ROPE.

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**Samples of rope furnished for the elevator of the Washington Monument.**



No. 5487.

Ends of rope secured in cast-iron conical-shaped sockets, by means of wedges.

Length between sockets, 8' 1½''.

Diameter of rope, 1½''.

Six strands with hemp core.

Tensile strength, 123,100 pounds.

Fractured wires at face of socket.

No. 5488.

Ends of rope secured in cast-iron sockets, in same manner as No. 5487.

Length between sockets, 8' 1½''.

Diameter of rope, 1½''.

Six strands with hemp core.

Tensile strength, 121,400 pounds.

Fractured wires at face of socket.

No. 5522.

Total length, 8' 10''.

Diameter of rope, 1½''.

Six strands, of nineteen wires each, with hemp core.

Secured in testing machine by clamping between cast-iron dies 18'' long, grooved to fit the wire strands.

Tensile strength, 125,100 pounds.

Fractured two wire strands 2 feet from face of cast-iron dies.

No. 5523.

Total length, 8' 10".

Diameter of rope, 1½".

Six strands of nineteen wires each, with hemp core.

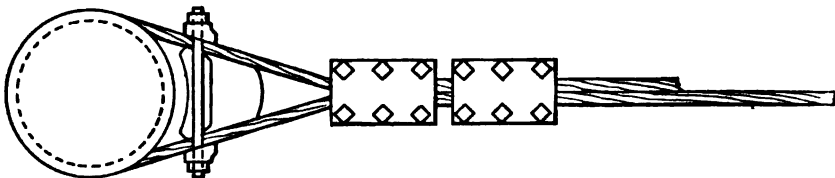
Secured in testing machine with same dies as No. 5522.

Tensile strength, 123,500 pounds.

Fractured two wire strands from 2" to 3" from face of cast-iron dies.

No. 5544.

Methods of securing ends for testing.



Diameter of rope, 1½".

Six strands with hemp core.

Tensile strength, 130,600 pounds.

Fractured at inside face of second clamp.

TENSILE STRENGTH OF NICKEL STEEL WIRE MANUFACTURED BY CARNEGIE, PHIPPS & CO., LIMITED, PITTSBURG, PA.

No. 5548.

Diameter, ".245.

Sectional area, .0471 square inch.

Gauged length, 10".

Specimen straightened in rolls from a coil.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
235	5,000	0.	0.	0.	0.	Initial load.
471	10,000	.00015	.00015	.....	.....	
706	15,000	.00038	.00023	.....	.....	
942	20,000	.00058	.00020	.....	.....	
1,177	25,000	.00074	.00016	.....	.....	
1,418	30,000	.00093	.00019	.....	.....	
1,648	35,000	.00113	.00020	.....	.....	E = 30,610,000.
1,884	40,000	.00129	.00016	.....	.....	Elastic limit.
2,119	45,000	.00180	.00051	.00039	.....	
2,355	50,000	.00273	.00093	.....	.....	
2,590	55,000	.00351	.00378	.00480	.....	
2,826	60,000	.019	.01249	.....	.....	
3,061	65,000	.028	.009	.....	.....	
3,297	70,000	.039	.011	.....	.....	
3,532	75,000	.054	.015	.....	.....	
3,768	80,000	.065	.031	.....	.....	
3,944	83,740	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section ..... pounds.. 83,740  
 Elastic limit per square inch of original section ..... do... 40,000  
 Elongation per inch after rupture..... inch... .120  
 Elongation per inch under strain at elastic limit ..... do... .00129  
 Reduction in diameter at point of rupture..... do... .075  
 Reduction in area after rupture, per cent of original section..... do... 51.8  
 Position of rupture..... 1 1/2" outside the gauged section  
 Character of broken surface, silky. Cracks along surface in the vicinity of fracture in two lines on opposite sides of the wire where thin fins had been rolled down.



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## NATURAL STONES.

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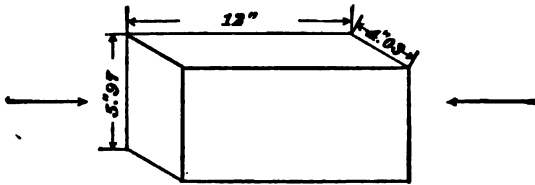
The stones tested hot were slowly heated in a sheet-iron muffle by means of gas burners. They were taken from the muffle and immediately tested in the open air.





**CAPE ANN GRANITE.**

No. 5676.



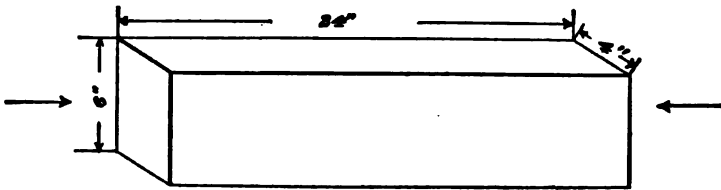
Not heated.

Sectional area, 24.06 square inches.

Ultimate strength, 417,300 pounds=17,340 pounds per square inch.

**CAPE ANN GRANITE.**

No. 5773.



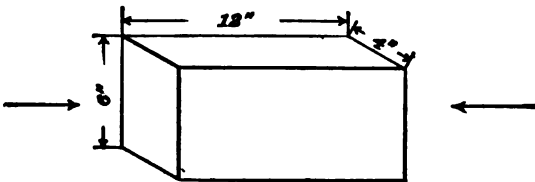
Temperature, about 720° Fahr.

Sectional area, 24 square inches.

Ultimate strength, 275,200 pounds=11,467 pounds per square inch.

**QUINCY GRANITE.**

No. 5777.



Temperature, about 440° Fahr.

Sectional area, 24 square inches.

Snapping sounds were heard at 243,000 pounds compression.

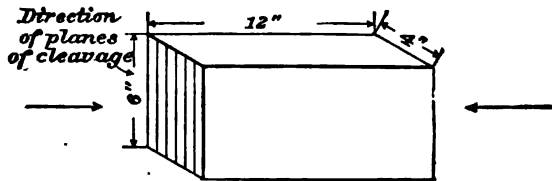
Ultimate strength, 390,900 pounds=16,287 pounds per square inch.

Pyramidal fracture.

## NATURAL STONES.

## MONSON SLATE.

No. 5776.



Temperature, about 440° Fahr.

Sectional area, 24 square inches.

Ultimate strength, 232,000 pounds=9,667 pounds per square inch.

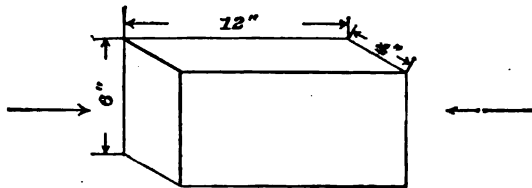
Laminated fracture following the planes of natural cleavage of the stone.

When taken out of the muffle and placed on a sheet of asbestos board preparatory to adjustment in the testing machine, being exposed at the time to an atmospheric temperature of 95° Fahr., two longitudinal cracks opened, one from each end of the specimen.

The cracks extended into the stone from 3 to 4 inches each.

## OHIO SANDSTONE.

No. 5778.



Temperature, about 435° Fahr.

Sectional area, 24 square inches.

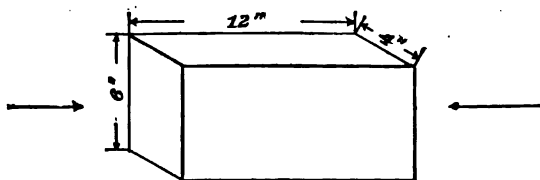
Snapping sounds under 181,000 pounds compression.

Ultimate strength, 183,900 pounds=7,663 pounds per square inch.

Pyramidal fracture.

## VERMONT MARBLE.

No. 5779.



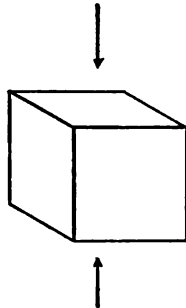
Temperature, about 435° Fahr.

Sectional area, 24 square inches.

Ultimate strength, 320,900 pounds=13,271 pounds per square inch.

Explosive fracture under the maximum load.

**COMPRESSION OF LIMESTONE CUBES FROM KELLY ISLAND, LAKE ERIE, AND USED IN THE CONSTRUCTION OF 300-FOOT LOCK AT SAULT STE. MARIE, MICH.**



Compressed surfaces faced with plaster of Paris.

No. of test.	Marks.	Dimensions.			Sectional area.	Firstcrack.	Ultimate strength.	
		Height.	Compressed sur face.				Total.	Per square inch.
		<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Sq. inches.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>
5663	0	2.98	2.98	2.98	8.88	105,800	105,800	11,910
5664	1	2.99	2.99	2.99	8.94	115,280	115,280	12,890
5665	3	2.98	2.98	2.98	8.88	112,490	112,490	12,670
5666	4	2.95	3.00	2.98	8.94	58,000	74,100	8,290
5667	6	3.00	2.97	2.97	8.82	89,000	90,900	10,980
5668	17	2.98	2.98	2.98	8.88	111,280	111,260	12,530
5669	22	2.97	2.96	2.99	8.85	111,590	111,590	12,610
5670	27	3.00	2.98	2.98	8.88	117,200	117,200	13,200
5671	30	2.98	2.98	2.99	8.91	128,200	129,300	14,500

Pyramidal fractures.

H. Ex. 43—39

## CHEMICAL COMPOSITION OF NATURAL STONES AND CEMENTS.

Description.	SiO <sub>2</sub>	Fe <sub>2</sub> O <sub>3</sub>	Al <sub>2</sub> O <sub>3</sub>	CaO	MgO	Na <sub>2</sub> O	K <sub>2</sub> O	SO <sub>3</sub>	P <sub>2</sub> O <sub>5</sub>	CO <sub>2</sub>	MnO	Loss.
<b>Sandstone:</b>												
Potomac red .....	76.41	4.35	15.54	0.35	1.15			None	None			2.20
Portland red .....	72.95	4.12	12.82	5.57	2.40			do	do			2.14
Ohio .....	91.20	1.14	6.24	0.73	0.68			do	do			0.06
<b>Slate, Monson</b> .....	54.24	8.89	24.71	5.23	2.59	1.48	0.72	2.03	do			0.16
<b>Bluestone, North River</b> .....	79.30	5.34	13.49	0.51	0.80			None	do	0.50		0.46
<b>Granite:</b>												
Cape Ann .....	81.05	2.71	14.70	1.10	Trace			do	do			0.44
Cincy .....	81.10	4.72	12.60	1.14	do			do	do			0.44
Worcester .....	78.81	1.50	15.92	1.17	do			do	do			2.15
<b>Limestone, Hoosier Buff Oolitic</b> .....	2.40	0.33		50.50	3.37			Trace	do	43.34		0.06
<b>Marble:</b>												
Vermont .....	1.64	0.21		52.09	2.00			0.53	do	43.00		0.48
Lee .....	1.00	0.20		23.00	27.96			0.64	do	46.64		0.54
<b>Cement:</b>												
Portland .....	13.88	11.57		62.69	2.75			1.12		3.45		0.04
Rofman .....	24.60	10.50		39.31	15.04			1.37		9.14		None
Norton .....	25.35	10.48		38.76	16.63			1.27		8.50		0.02
Cement .....	23.17	13.25		33.17	21.00			1.93		6.38		None



## CORDAGE.

## MANILA AND RUSSIAN HEMP FROM WATERVLJET ARSENAL (SAMPLES OF OLD ROPE).

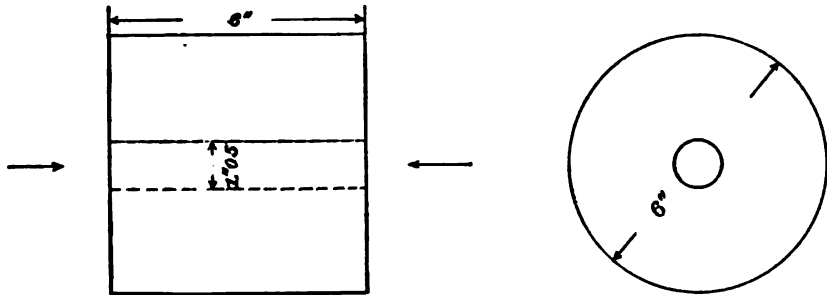
Prepared for testing by splicing eyes in ends and wetting the splices before testing.



No. of test.	Kind of rope.	Marks.	Circumference.	Number of strands.	Yarns per strand.	Lay one turn in inches.	Length.
5681	Manila .....	B	<i>Inches.</i> 4½	3	63	2½	<i>Feet.</i> 6
5682	...do .....	A	6½	3	128	4½	3½
5683	Russian hemp.....	D	6	3	89	4½	4
5684	...do .....	C	6½	3	88	5½	4½

No. of test.	Tensile strength.	Fractured.
5681	<i>Pounds.</i> 11, 850	1 strand at end of splice.
5682	18, 180	Do.
5683	18, 620	2 strands at end of splice.
5684	19, 820	1 strand at middle of length.

COMPRESSION OF RUBBER BUFFERS.



Buffers brauded: "Newton Rubber Co. Factory, Newton Upper Falls, Mass."

No. 5769.

Weight, 10 pounds 7½ ounces.

Applied loads.	Height.	Total compression.	Successive compression.	Permanent set.	Middle diameter.
Pounds.	Inches.	Inches.	Inch.	Inch.	Inches.
0	6.00	0.	0.	0.	6.00
200	5.89	.11	.11	.....	6.04
400	5.83	.17	.06	.....	6.07
600	5.75	.25	.08	.....	6.12
800	5.70	.30	.05	.....	6.16
1,000	5.64	.36	.06	.....	6.18
2,000	5.29	.71	.35	.....	6.43
3,000	4.90	1.10	.39	.....	6.70
4,000	4.54	1.46	.36	.....	6.99
5,000	4.24	1.76	.30	.....	7.25
6,000	4.00	2.00	.24	.....	7.47
7,000	3.78	2.22	.22	.....	7.68
8,000	3.55	2.45	.23	.....	7.94
9,000	3.38	2.62	.17	.....	8.15
10,000	3.24	2.76	.14	.....	8.32
11,000	3.07	2.93	.17	.....	8.54
12,000	3.00	3.00	.07	.....	8.66
13,000	2.92	3.08	.08	.....	8.76
14,000	2.83	3.17	.09	.....	8.89
15,000	2.76	3.24	.07	.....	8.99
16,000	2.70	3.30	.06	.....	9.10
17,000	2.64	3.36	.06	.....	9.18
18,000	2.60	3.40	.04	.....	9.27
19,000	2.55	3.45	.05	.....	9.36
20,000	2.51	3.49	.04	.....	9.45
18,000	2.53	3.47	-.02	.....	.....
16,000	2.58	3.42	-.05	.....	.....
14,000	2.63	3.37	-.05	.....	.....
12,000	2.72	3.28	-.09	.....	.....
10,000	2.84	3.16	-.12	.....	.....
8,000	3.02	2.98	-.18	.....	.....
6,000	3.38	2.62	-.36	.....	.....
4,000	4.08	1.92	-.70	.....	.....
2,000	5.00	1.00	-.92	.....	.....
0	5.93	.....	.....	.07	6.12

No. 5770.

Weight, 10 pounds 9½ ounces.

Applied loads.	Height.	Total compression.	Successive compression.	Permanent set.	Middle diameter.
<i>Pounds.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inch</i>	<i>Inch.</i>	<i>Inches.</i>
0	6.00	0	0	0	6.00
200	5.94	.06	.06	-----	6.04
400	5.88	.12	.06	-----	6.08
600	5.81	.19	.07	-----	6.12
800	5.76	.24	.05	-----	6.16
1,000	5.69	.31	.07	-----	6.19
2,000	5.36	.64	.33	-----	6.41
3,000	4.99	1.01	.37	-----	6.68
4,000	4.65	1.35	.34	-----	6.94
5,000	4.34	1.66	.31	-----	7.20
6,000	4.10	1.90	.24	-----	7.43
7,000	3.87	2.13	.21	-----	7.65
8,000	3.68	2.32	.19	-----	7.86
9,000	3.50	2.50	.28	-----	8.05
10,000	3.34	2.66	.16	-----	8.21
11,000	3.22	2.78	.12	-----	8.38
12,000	3.11	2.89	.11	-----	8.53
14,000	2.93	3.07	.18	-----	8.77
16,000	2.80	3.20	.13	-----	8.98
18,000	2.68	3.32	.12	-----	9.18
20,000	2.58	3.42	.10	-----	9.36
0	5.95	-----	-----	.05	6.12



CHEMICAL ANALYSES OF STEEL, WROUGHT IRON, AND CAST IRON.

Description of material.	Chemical composition.										Remarks.
	Carbon.			Manganese.	Silicon.	Sulphur.	Phosphorus.	Copper.			
	Total.	Graphitic.	Combined.								
Wrought iron marked S-220.....	0.049	0.010	0.039	None.	0.118	0.020	0.141				See report of 1892, p. 192, for original tenon test.
Cast iron—12" mortar shell.....	3.004	1.434	1.570	0.310	1.073	0.190	0.580				First ladle.
Do.....	3.021	1.382	1.639	0.304	0.860	0.196	0.600				Last ladle.
Do.....	2.941	2.233	0.708	0.263	0.896	0.127	0.434				Heat No. 1.
Do.....	2.954	1.897	0.997	0.124	0.056	0.196	0.366	None.			Heat No. 2.
Do.....	3.155	2.927	0.228	0.588	0.968	0.094	0.566	0.006			Heat No. 50.
Gun scrap.....	2.569	1.897	0.682	0.387	0.820	0.025	0.538				
8-inch round shot (old).....	2.663	2.448	0.215	1.360	2.931	0.035	0.652				
Muirkirk pig iron.....	3.467	3.073	0.394	0.872	0.858	0.096	0.233	None.			
Do.....	2.751	2.042	0.709	0.760	0.760	0.105	0.480				
Katahdin pig iron.....	2.668	1.832	0.834	0.100	1.170	0.069	0.478				
Do.....	3.116	2.344	0.772	0.138	1.026	0.096	0.573				
Alabama pig iron.....	2.386	1.362	1.004	.....	3.265	0.010	.....				
Do.....	3.265	2.803	0.462	1.068	4.097	0.005	1.185				
Ohio pig iron.....	2.968	2.787	0.201	.....	2.754	0.006	.....				
Shaparon pig iron.....	2.492	1.870	0.622	0.252	0.578	0.048	0.620				
Standard Steel Co.'s tool steel 1 1/2" x 1/2".....	0.897	0.028	0.869	0.148	0.111	0.010	0.024				
Cold rolled steel for endurance tests.....	0.075	None.	0.075	0.320	0.025	0.061	0.091	0.010			
Helical spring, 1/2" diameter.....	1.047	0.156	0.891	0.356	0.294	0.043	0.068	0.012			
Helical spring, 3/8" x 1/2".....	1.198	0.226	0.972	0.191	0.125	0.014	0.077	0.014			
English Belleville spring.....	0.776	0.046	0.730	0.615	0.012	.....	.....				
French Belleville spring.....	.....	0.296	0.710	0.710	0.257	.....	.....				
Spring steel in stock at arsenal.....	0.697	0.076	0.621	0.562	0.075	0.025	0.058	0.012			To be manufactured at Watertown Arsenal.
Spring steel from Lynn.....	0.635	0.012	0.623	0.455	0.326	0.015	0.045	.....			
Steel disks from Belleville springs.....	0.694	0.054	0.640	0.532	0.037	0.030	0.092	.....			

TESTS MADE FOR PRIVATE PARTIES DURING THE FISCAL YEAR  
ENDED JUNE 30, 1892.

Date.	Material.	For whom tested.		
		Name.	City.	State.
1891.				
July 2	Riveted joints	Camden Iron Works	Camden	N. J.
	Eyebar	Keystone Bridge Co	Pittsburg	Pa.
8	Steel plates	Edwd. Kendall & Sons	Cambridgeport	Mass.
11	Copper wire	U. S. Cold Wire Rolling Co	Chicago	Ill.
16	Wrought iron	Houghton & Richards	Boston	Mass.
17	Chain	Thos. Morton	New York	N. Y.
24	Staybolt iron	Rhode Island Locomotive Works	Providence	R. I.
	Cast iron	Woodbury Merrill	Boston	Mass.
		Patten & Woodbury		
27	Steel rails	P. H. Dudley	New York	N. Y.
	Bricks	F. Chillingworth	New Haven	Conn.
	Granite	Alex. McDonald & Son	Cambridge	Mass.
Aug. 3	Cement	Atlas Cement Co	New York	N. Y.
	Steel plates	Wm. Allen & Sons	Worcester	Mass.
4	Terra cotta	Peabody & Stearns	Boston	Mass.
	Brick	J. L. Smithmeyer	Fort Monroe	Va.
11	Staybolt iron	Rhode Island Locomotive Works	Providence	R. I.
12	Bricks	Granite State Brick Co	Boston	Mass.
	do	Philadelphia & Boston Face Brick Co.	do	Mass.
13	Terra cotta	Peter Condon	New York	N. Y.
	Paving blocks	H. Gore & Co.	Boston	Mass.
14	Steel plates	Edwd. Kendall & Sons	Cambridgeport	Mass.
18	do	do	do	Mass.
24	Bricks and stone	F. Chillingworth	New Haven	Conn.
25	Insulators, etc.	The Gould and Watson Co	Boston	Mass.
	Aluminum bronze	The Aluminum Brass and Bronze Co.	Bridgeport	Conn.
Sept. 1	Cast iron	Chatham Furnace Co	Chatham	N. Y.
	Brass rod	Union Metallic Cartridge Co	Bridgeport	Conn.
	Wrought iron	B. M. Jones & Co	Boston	Mass.
	Steel plates	Wm. Allen & Sons	Worcester	Mass.
2	Fireproofing	W. M. Kasson	Boston	Mass.
7	Steel plates	Edwd. Kendall & Sons	Cambridgeport	Mass.
	Shackle	James B. Mills	Rockland	Me.
14	Insulators	The Gould and Watson Co	Boston	Mass.
15	Steel plate	Edwd. Kendall & Sons	Cambridgeport	Mass.
17	Fireproofing	W. M. Kasson	Boston	Mass.
19	Rail and rail joint.	Nickerson Fish Plate Co	do	Mass.
	Wrought iron and steel plates.	Cunningham Iron Works Co	do	Mass.
22	Steel plates	Edwd. Kendall & Sons	Cambridgeport	Mass.
23	Wrought iron plates.	Cunningham Iron Works Co	Boston	Mass.
Oct. 29	Steel plates	Edwd. Kendall & Sons	Cambridgeport	Mass.
3	do	do	do	Mass.
14	do	Hartford Steam Boiler Inspection and Insurance Co.	Boston	Mass.
	Wrought iron and side rod.	Houghton & Richards	do	Mass.
15	Steel plate	Edwd. Kendall & Sons	Cambridgeport	Mass.
20	Steel plates	Wm. Allen & Sons	Worcester	Mass.
24	Pine wood	A. Gottlieb & Co	Chicago	Ill.
29	Columns	Jones & Laughlin, limited	do	Ill.
31	Steel plates	Edwd. Kendall & Sons	Cambridgeport	Mass.
	Wrought iron bars	E. W. Serrell	New York	N. Y.
Nov. 6	Bricks	J. H. Warden	Chicago	Ill.
7	Steel plates	Edwd. Kendall & Sons	Cambridgeport	Mass.
9	Brass and bronze	American Tool and Machine Co	Boston	Mass.
12	Chain cable	Riehlé Bros. Testing Machine Co	Philadelphia	Pa.
18	Hardened steel	Ferracute Machine Co	Bridgton	N. J.
19	Wrought iron	Eastern Forge Co	Boston	Mass.
23	Steel plates	Wm. Allen & Sons	Worcester	Mass.
Dec. 1	Brick	National Brick and Tile Co	Bradford	Pa.
	Chains	Fitchburg R. R. Co	Boston	Mass.
	Granite	Cross G. Smith	do	Mass.
7	Steel plates	Bogers Locomotive and Machine Works.	Paterson	N. J.
8	do	Edwd. Kendall & Sons	Cambridgeport	Mass.
	Sheet copper	Chas. R. Fletcher	Boston	Mass.
9	Yellow metal	Revere Copper Co	do	Mass.
11	Cast copper	Herbert Howell	do	Mass.
12	Belting	Main Belting Co	do	Mass.
	Wrought iron plates.	Erskine Ramsey	Pratt Mines	Ala.
19	Composition metal	Bath Iron Works	Bath	Me.
	Belting	Main Belting Co	Boston	Mass.
31	Steel plates	Wm. Allen & Sons	Worcester	Mass.

PRIVATE TESTS—Continued.

Date.	Material.	For whom located.		
		Name.	City.	State.
1892.				
Jan. 4	Steel castings	W. W. Whitcomb	Boston	Mass.
	Aluminum alloys	Prof. J. W. Richards	Bethlehem	Pa.
5	Bricks	Eastern Hydraulic Press Brick Co.	Winslow	N. J.
6	Brick, stone, and piers.	Wm. Sooy Smith	Chicago	Ill.
8	Terra cotta	Corning Clay Works	St. Paul	Minn.
	Pine wood columns.	Pepperell Manufacturing Co.	Biddeford	Me.
9	Steel plates	Wm. Allen & Sons	Worcester	Mass.
	Steel bars	Washburn Car Wheel Co.	do	Mass.
	Yellow metal	Revere Copper Co.	Boston	Mass.
Feb. 4	Paving bricks	Muscatine Terra Cotta Lumber Co.	Muscatine	Iowa.
5	Steel bar.	Washburn Car Wheel Co.	Worcester	Mass.
	Yellow metal	Revere Copper Co.	Boston	Mass.
10	Steel plate	Edwd. Kendall & Sons	Cambridgeport	Mass.
	Steel plates	Whittier Machine Co.	Boston	Mass.
	do	Holyoke Steam Boiler and Iron Works.	Holyoke	Mass.
	Angle iron	Boston Bridge Works.	Boston	Mass.
	Cast iron	Wm. Allen & Sons	Worcester	Mass.
	Staybolt iron	Rhode Island Locomotive Works	Providence	R. I.
	do	Houghton & Richards	Boston	Mass.
	Wrought iron rods and nuts.	H. S. Robinson	do	Mass.
11	Steel plates	E. D. Leavitt	Cambridgeport	Mass.
17	Terra cotta	New York Architectural Terra Cotta Co.	New York	N. Y.
	Cast iron	Potter Machine Works	Newton Upper Falls.	Mass.
18	Paving bricks	H. Gore & Co.	Boston	Mass.
19	Carriage axle	B. M. Jones & Co.	do	Mass.
23	Railroad axles	N. Y., N. H. & Hartford R. E. Co.	New Haven	Conn.
24	Railway chairs	Burnham & Duggan Railway Appliance Co.	Boston	Mass.
	Riveted joints and steel plate.	Hartford Steam Boiler Inspection and Insurance Co.	Hartford	Conn.
	Steel plate	Edwd. Kindall & Sons	Cambridgeport	Mass.
27	Cast iron column	Leacona Co.	Biddeford	Me.
	Wire rope	C. U. Cotting	Boston	Mass.
	Iron and steel.	Lehigh Valley R. R. Co.	South Bethlehem	Pa.
	Steel plate	Edwd. Kendall & Sons	Cambridgeport	Mass.
Mar. 1	Sewer covers	City of Boston	Boston	Mass.
3	Cast iron	Golding & Co.	do	Mass.
4	Bricks	New York Architectural Terra Cotta Co.	New York	N. Y.
	do	E. D. Leavitt	Cambridgeport	Mass.
7	Spirally welded tube.	Spiral Weld Tube Co.	East Orange	N. J.
8	Bricks	New York Architectural Terra Cotta Co.	New York	N. Y.
14	Wrought iron bars	Edwd. Kendall & Sons	Cambridgeport	Mass.
15	do	Kinsley Iron and Machine Co.	Canton	Mass.
	Iron plates	Pettee Machine Works	Newton Upper Falls.	Mass.
16	Steel plates	E. D. Leavitt	Cambridgeport	Mass.
25	Wrought iron column.	A. J. Gustin	South Boston	Mass.
26	Paving brick	Shawmut Clay Manufacturing Co.	Ridgway	Pa.
28	Steel and iron bars	Kinsley Iron and Machine Co.	Canton	Mass.
31	Steel plates	E. D. Leavitt	Cambridgeport	Mass.
Apr. 4	do	do	do	Mass.
6	Angle iron	Boston Bridge Works	Boston	Mass.
	Steel plates	William Allen & Sons	Worcester	Mass.
	do	Carnegie, Phipps & Co., Limited	Pittsburg	Pa.
	Rods with caps nuts.	H. S. Robinson	East Boston	Mass.
7	Wrought iron bars	Houghton & Richards	Boston	Mass.
8	Spirally welded tube.	Spiral Weld Tube Co.	East Orange	N. J.
15	Fireproof granite.	William F. Stedman	South Boston	Mass.
	Bricks	J. C. Hubinger & Co.	Kookuk	Iowa.
16	Steel bars	E. D. Leavitt	Cambridgeport	Mass.
23	Wrought iron and steel bars.	Edwd. Kendall & Sons	do	Mass.
	Steel plates	Cunningham Iron Works Co.	Boston	Mass.
	do	Carnegie, Phipps & Co., Limited	Pittsburg	Pa.
	Artificial stone	Carnart & Blanchard	New York	N. Y.
	Pole insulator	Revere Rubber Co.	Boston	Mass.
	Chain	Memphis Artesian Water Co.	Memphis	Tenn.

## PRIVATE TESTS.

## PRIVATE TESTS—Continued.

Date.	Material.	For whom tested.		
		Name.	City.	State.
1892.				
Apr. 25	Steel plates .....	Edwd. Kendall & Sons .....	Cambridgeport ..	Mass.
26	do .....	E. D. Leavitt .....	do .....	Mass.
May 9	Artificial stone ..	Carhart & Blanchard .....	New York .....	N. Y.
10	Chain .....	J. B. Carr & Co .....	Troy .....	N. Y.
	Brass tube .....	American Tube Works .....	Boston .....	Mass.
	Steel plates .....	E. D. Leavitt .....	Cambridgeport ..	Mass.
12	Insulators .....	Revere Rubber Co .....	Boston .....	Mass.
27	Rubber belting ..	J. H. Lane & Co .....	do .....	Mass.
28	Insulators .....	Revere Rubber Co .....	do .....	Mass.
31	Steel rails .....	P. H. Dudley .....	New York .....	N. Y.
June 1	Riveted joints, steel plates, bronze.	Hartford Steam Boiler Inspection and Insurance Co.	Hartford .....	Conn.
3	Steel rails .....	P. H. Dudley .....	New York .....	N. Y.
7	Bricks .....	New England Steam Brick Co .....	Barrington .....	R. I.
8	Chain swivel .....	Bradlee & Co .....	Philadelphia .....	Pa.
	Steel plates .....	Boston Bridge Works .....	Boston .....	Mass.
16	Wire rope .....	E. G. Aikman .....	New York .....	N. Y.
18	Wrought iron bars	Houghton & Richards .....	Boston .....	Mass.
22	Wire joints .....	American Bell Telephone Co .....	South Boston .....	Mass.
28	Stay bolt .....	George H. Lloyd .....	Boston .....	Mass.
29	Cement .....	Lehigh Valley R. R. Co .....	Jersey City .....	N. J.
30	Card clothing .....	Mechanical Fabric Co .....	Providence .....	R. I.

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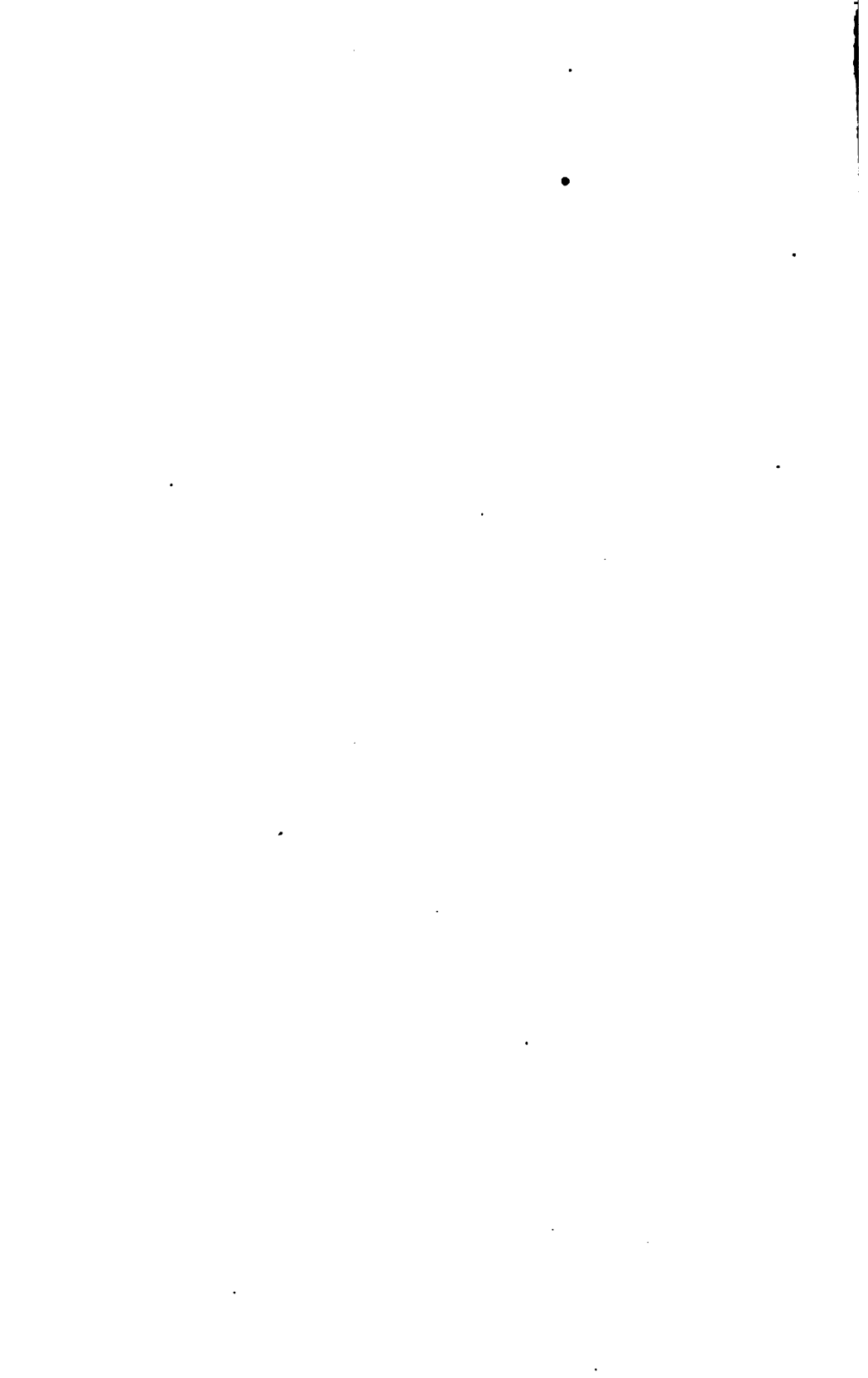
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